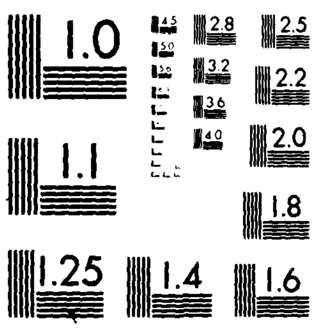
AD-A099 490 NATIONAL TELECOMMUNICATIONS/INFORMATION ADMINISTRATIO--ETC F/G 17/2.1
SELECTIVE FADING ON 8 GHZ LONG PATHS IN EUROPE.(U)
MAR 80 L G HAUSE DCFR-040022

UNCLASSIFIED DCEC-R-040022 NL

1 of 2
AD A099490

994



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

AD A099490

LEVEL II

R-040022

DEFENSE COMMUNICATIONS ENGINEERING CENTER

REPORT NO. 040022

SELECTIVE FADING ON 8 GHz LONG PATHS IN EUROPE

MARCH 1981

APPROVED FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

PREPARED FOR THE DEFENSE COMMUNICATIONS AGENCY BY
THE INSTITUTE FOR TELECOMMUNICATION SCIENCES, NATIONAL
TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION,
U.S. DEPARTMENT OF COMMERCE

LCFK-CHECK [illegible]
Constant pres [illegible]

UNCLASSIFIED March 1980

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: 18 DCEC R-040022	2. GOVT ACCESSION NO.: AD-A099 490
	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): 6 Selective Fading on 8 GHz Long Paths in Europe.	5. TYPE OF REPORT & PERIOD COVERED: 02/01/80-12/30/80
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): 10 Laurance G. Hause	8. CONTRACT OR GRANT NUMBER(s): 15 DCFR-040022
9. PERFORMING ORGANIZATION NAME AND ADDRESS: ITS/NTIA/DoC 325 Broadway Boulder, CO 80303	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: Defense Communications Engineering Center Transmission System Development Branch, R220 1860 Wiehle Avenue, Reston, VA 22090	12. REPORT DATE: 11 March 1980
	13. NUMBER OF PAGES: 95
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): 12 99	15. SECURITY CLASS. (of this report): Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE: N/A

16. DISTRIBUTION STATEMENT (of this Report)

9 Final rept. no. 3, 1 Feb-30 Dec 80

Approved for ~~public release; distribution unlimited.~~

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

This is Report No. 3 in a series on Frequency Selective Fading being published by DCEC.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

selective fading; multipath distortion; microwave radio; digital radio; diversity

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report presents the description, analysis, and results of a set of measurements made to obtain statistics about the distortion of the frequency spectrum amplitude across the IF band of a 3-level-partial-response, digital line-of-sight, microwave radio system. The length of path was about 90 km. Results show that for line-of-sight systems:

(1) Large values of distortion (1 dB/MHz) were observed during multipath fading events; → (Abstract cont's on reverse side)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

410 139 SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

cont

(2) Diversity reception looks very promising as an effective tool in counteracting these distortion effects,

(3) Multipath received-signal-level statistics can be used to predict the frequency and severity of this type of distortion on a line-of-sight path; and

(4) The 3-level-partial-response modulation system used here was very robust in terms of its susceptibility to the severity of amplitude distortion observed on this path during the measurements.

SELECTIVE FADING ON 8 GHz LONG PATHS IN EUROPE

by

Laurance G. Hause

NATIONAL TELECOMMUNICATIONS AND INFORMATION ADMINISTRATION
INSTITUTE FOR TELECOMMUNICATION SCIENCES
BOULDER, COLORADO

PREFACE

This publication* presents results of an R&D project funded by DCA and carried out by the Institute for Telecommunication Sciences (ITS), Boulder, CO. This effort involved the collection and analysis of propagation data from several digital line-of-sight microwave links in the Digital European Backbone, Stage I. Concern for the presence and effect of frequency selective fading on DCS digital links prompted this project, as well as a series of other related projects.

Readers who have comments or questions regarding this report are encouraged to contact the author directly at ITS or Dr. David R. Smith at DCEC, Code R220, (Commercial) 703-437-2085, (VON) 364-2085.

---

* This publication is the third in a series of DCEC reports on frequency selective fading and its effects on DCS digital transmission system performance.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SELECTIVE FADING ON 8 GHz LONG PATHS IN EUROPE

Laurance G. Hause*

This report presents the description, analysis and results of a set of measurements made to obtain statistics about the distortion of the frequency spectrum amplitude across the IF band of a 3-level-partial-response, digital line-of-sight, microwave radio system. The length of path was about 90 km. Results show that for line-of-sight systems:

1) Large values of distortion (1 dB/MHz) were observed during multipath fading events.

2) Diversity reception looks very promising as an effective tool in counteracting these distortion effects.

3) Multipath received-signal-level statistics can be used to predict the frequency and severity of this type of distortion on a line-of-sight path.

4) The 3-level-partial-response modulation system used here was very robust in terms of its susceptibility to the severity of amplitude distortion observed on this path during the measurements.

Key words: selective fading; multipath distortion; microwave radio; digital radio; diversity

1. INTRODUCTION

Multipath fading in LOS links is known to cause short term outages when the signals from both the primary and diversity radio fade below the bit error rate threshold for flat fading. In addition, outages have been observed which occur at relatively high signal levels. These outages are often attributable to in-band (selective) fading.

To obtain statistics on selective fading and relate them to flat fading information, the Defense Communication Engineering Center (DCEC) provided Institute for Telecommunication Sciences (ITS) with tasking. The project consisted of a two month test by ITS to assist in determining the effect of selective multipath fading on digital line-of-sight microwave links. Data was collected within the Digital European Backbone Stage I (DEB I) on LOS links (see Figure 1) on which ITS had instrumentation installed for another test program. Data collected on this selective fading project was analyzed at the ITS laboratory. These results are needed for improving performance and design criteria for wideband digital LOS links.

---

*The author is with the Institute for Telecommunication Sciences, National Telecommunications and Information Administration, U.S. Department of Commerce, Boulder, CO 80303.

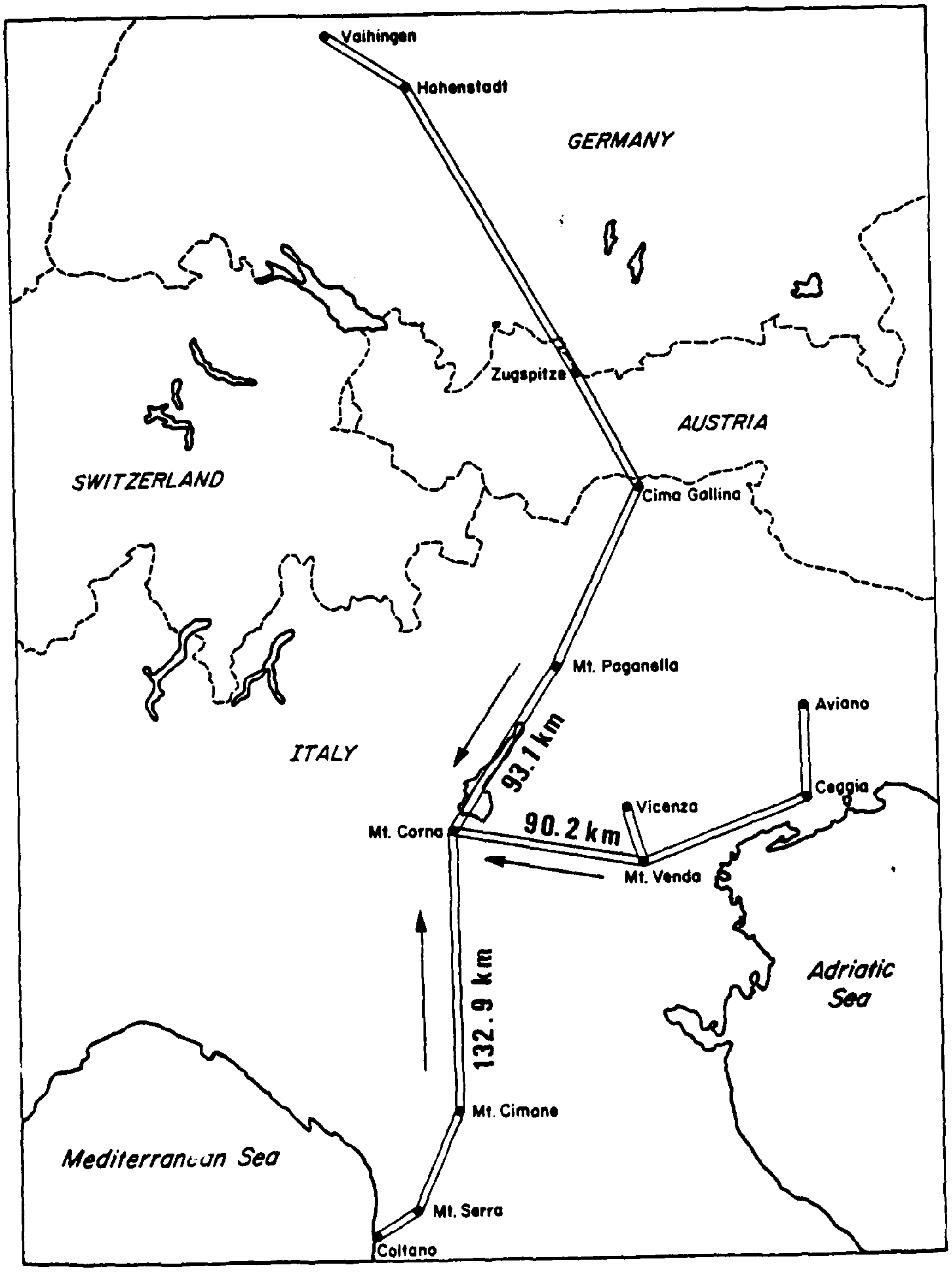


Figure 1. Line-of-sight microwave links converging at Mt. Corna, Italy.

Specific purposes of this selective-fading measurements program was to measure the amplitude distortion and other related parameters in order to answer the following questions:

1. How often does the amplitude distortion occur?
2. What is its range of severity?
3. What effect does the distortion have in producing errors in the DEB I system (12.6 Mb/s)?
4. Can the year-long, flat-fading statistics (recently measured for these paths) be quantitatively related to the in-band fading statistics?

In order to answer these questions, the following tasks were completed:

1. We conducted a literature survey of previous work accomplished in the area of selective fading on LOS links, including work published by Bell Labs, Bell Northern Research, and Collins Radio.
2. ITS installed, tested and calibrated an amplitude distortion measurement system at the Mt. Corna site.
3. ITS obtained in-band fading data over a two-month period on the primary and diversity radio pairs and measured various signals at selected times during periods of multipath fading. We continued to monitor and record the distributions of received signal levels that ITS had been previously monitoring on 8 GHz.
4. The signal spectrum data were analyzed to obtain the different values in dB across the signal frequency spectrum using a standard spectrum obtained during a quiet received signal level (RSL) period as a reference. In order to obtain distributions of the values of spectrum slope and in-band null depths, data searches were made on the basis of frame/format events and maximum spectral density differences across the band.

   All signal digitizing was done at the ITS Boulder Labs.

   The data was analyzed to obtain the following statistical parameters:

   4.1 Distribution of spectrum amplitude distortion observed during periods of flat fading.

   4.2 Distributions of selective fade durations.

   4.3 Distributions of rate of occurrence of selective fading.

   4.4 Correlation of flat fade depth with the presence of frequency selective fading.

   4.5 Correlation of frame loss and format violation events with selective fading events.

2. PREVIOUS WORK

Much work has been done to investigate the effects of selective fading on digital, LOS, microwave systems, for example (Dougherty and Hartman, 1977), (Anderson, et al., 1978), etc. The effort has resulted in combiners and equalizers which have greatly alleviated the effects of the distortion. A brief description of the mechanisms at work on LOS systems is provided by Smith and Osterholz (1979) pp. 15 - 26. The model presented by Smith and Osterholz indicates that the distortion will be particularly bad for long LOS paths for two reasons. The first reason is that the direct-path RSL is faded substantially below the median for a much larger fraction of the time than it is for short LOS paths. The second reason is that the potential for time dispersion between signal components is much greater on long paths than on short ones.

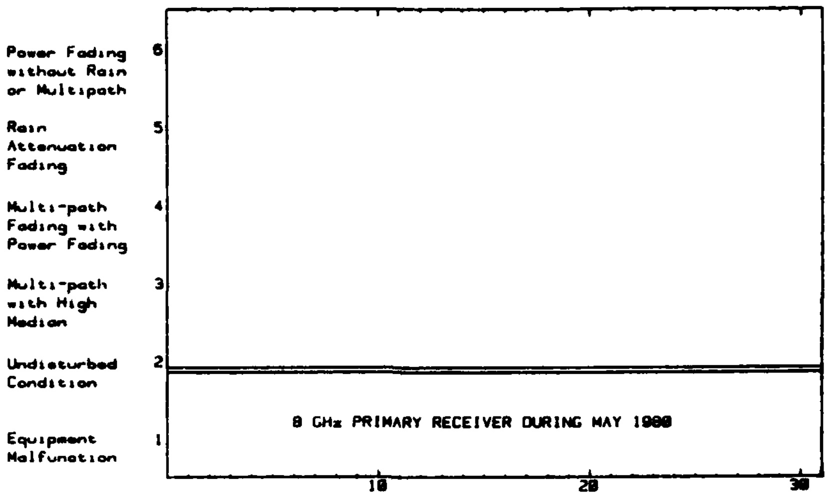
3. INSTRUMENTATION AND TEST OPERATIONS

The purpose of this section is to provide a description of the instrumentation system[1] used to measure and record spectrum amplitude distortion and other related signals of interest. The mode in which the instrumentation was used is also described.

The three links converging at Mt. Corna (Cimone-Corna, Venda-Corna, and Paganella-Corna) operate in a space diversity mode. The ITS instrumentation was all located at Mt. Corna and it had the capability of looking at only the two receivers associated with one of the paths at any given time. The observations on the Paganella-Corna path were very brief since very little multipath fading is observed on this path and for this reason it was abandoned for testing (Figures 2, 3, 4). The two receivers associated with each path are designated the "A" and "B" receiver. For these paths, the "B" receiver is the primary one and it is connected to the lowest antenna.

The Cimone-Corna path was monitored for approximately three weeks (the last part of April and the first part of May 1980). On May 8, 1980, the instrumentation was connected to the Venda receivers. The instrumentation was switched only once

[1] "Certain commercial equipment, instruments, or materials are identified in this paper to specify adequately the experimental procedure. In no case does such identification imply recommendation or endorsement by the National Telecommunications and Information Administration, nor does it imply that the material or equipment identified is necessarily the best available for the purpose."



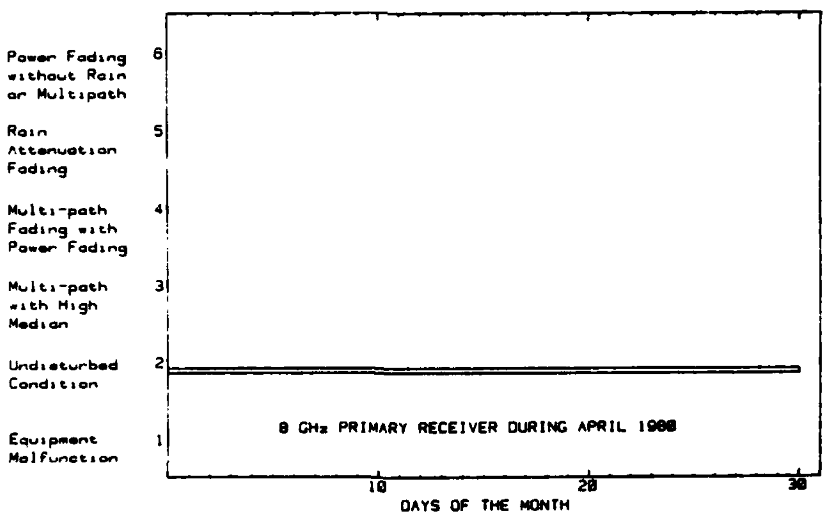


Figure 2. Chronological occurrence of each data category for the path from Mt. Paganella to Mt. Corna.

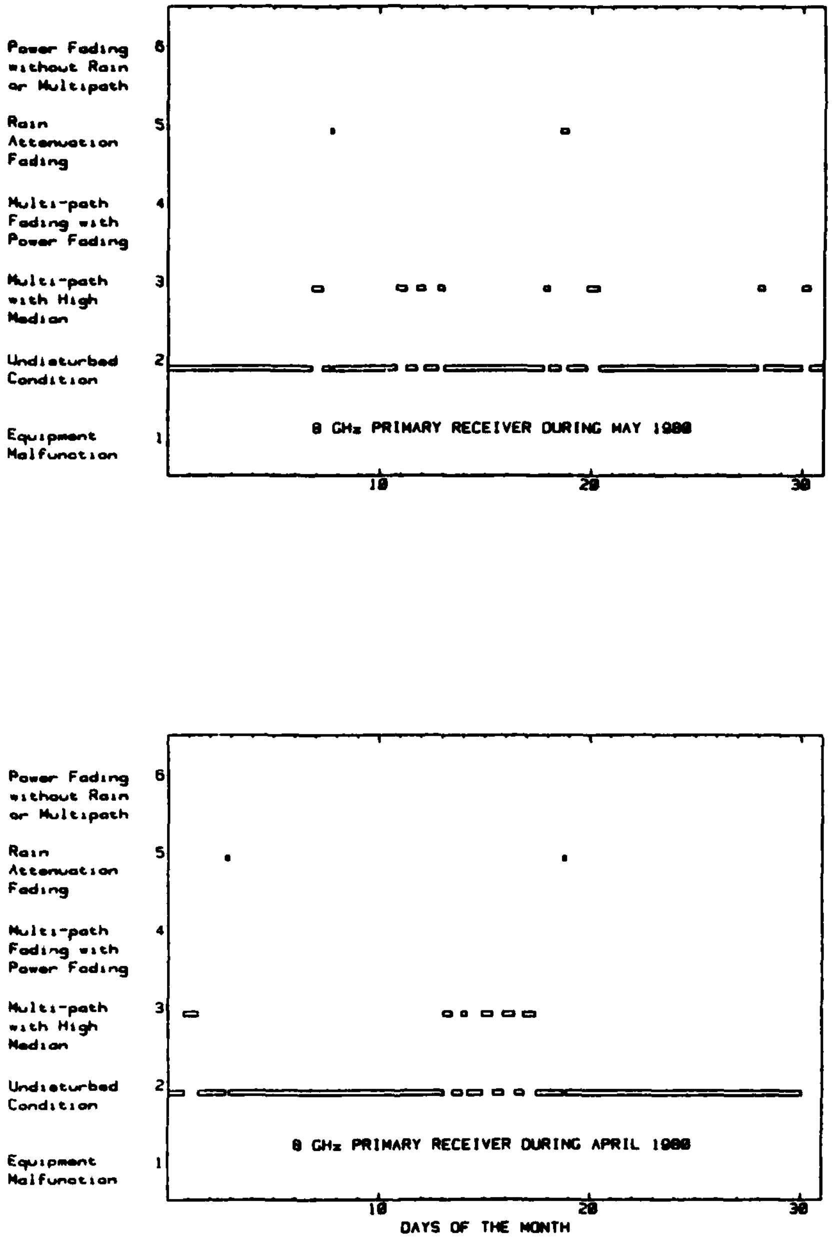
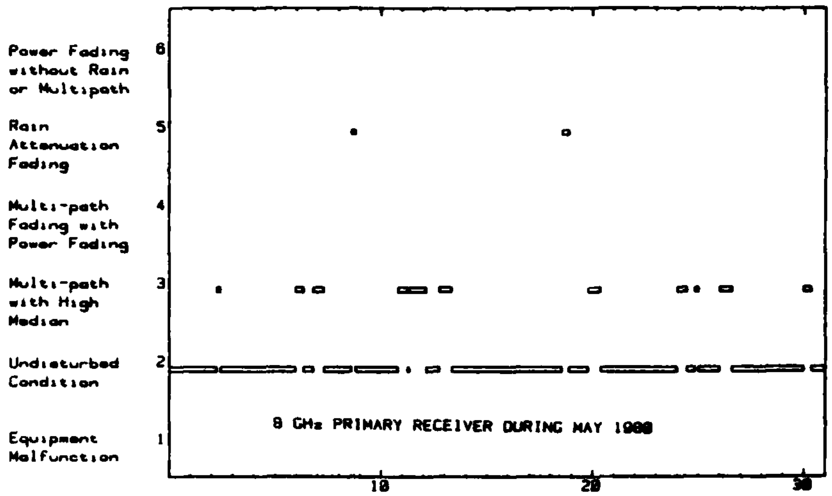


Figure 3. Chronological occurrence of each data category for the path from Mt. Venda to Mt. Corna.



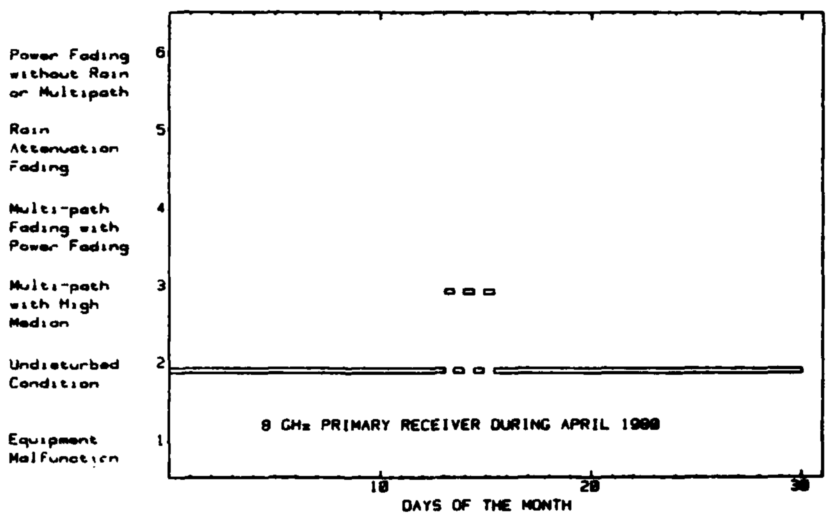


Figure 4. Chronological occurrence of each data category for the path from Mt. Cimone to Mt. Corna.

instead of frequently between paths (as was originally planned) because of the difficulty in verifying connections as well as the upsetting of communications operations. As seen in Figure 4, there was little fading during the last two weeks in April on the Cimone-Corna path. No significant data were obtained on the Cimone-Corna path until May 7, 1980. This 7-hour (2000-0300) data set is available but it was not digitized and analyzed in detail since it consisted of short periods of moderate fading. Resources of time, money, and specialized computer system access were exhausted even before completing the analysis of all of the Venda-Corna magnetic tapes. Visual observation of the May 7-8 data showed 2 hours of significant multipath amplitude distortion (slopes across the IF band greater than 0.2 dB/MHz). The preponderance of slopes was negative as in the case with the Venda-Corna path. Maximum multipath fading depth for the period was 30 dB. No diversity switching was observed during the 7-hour period.

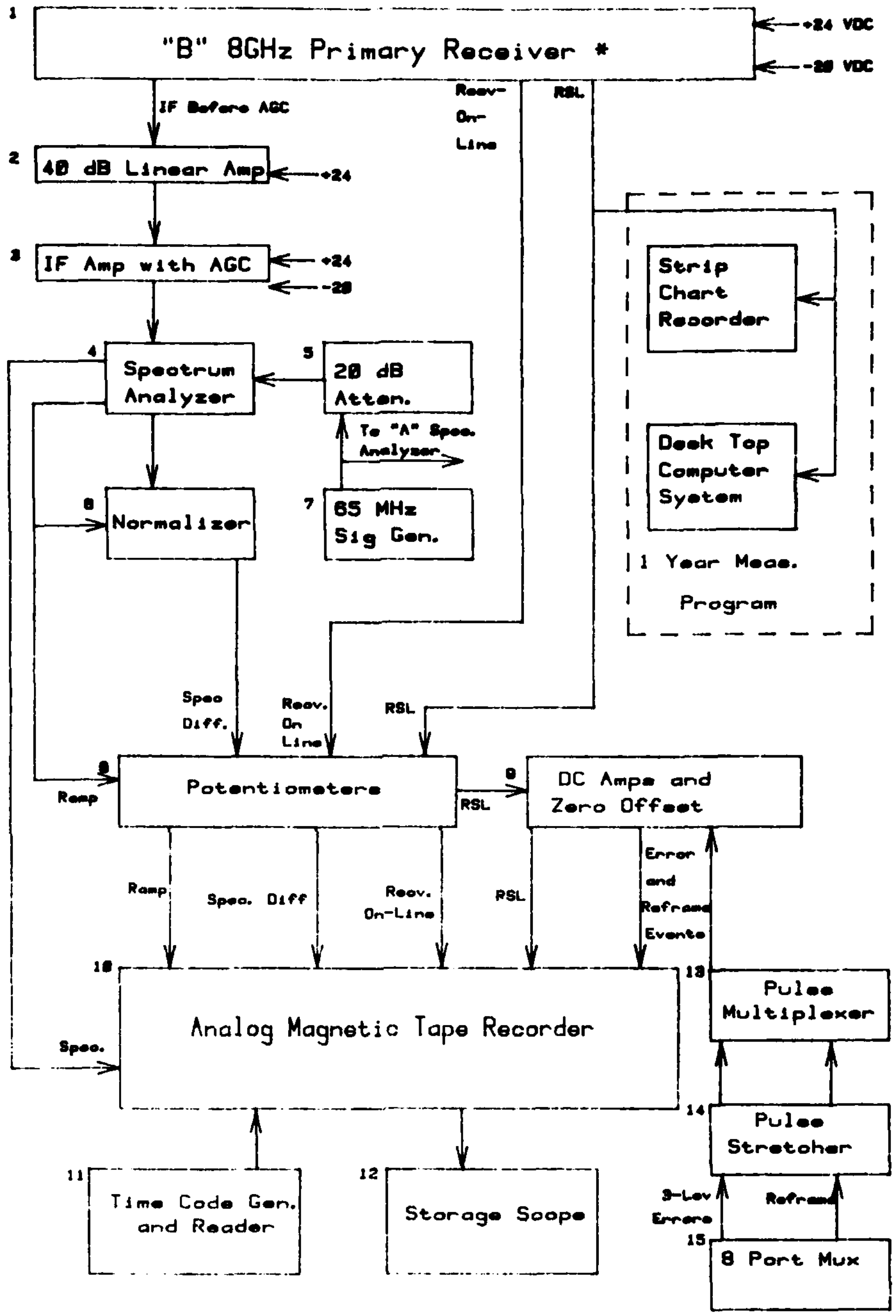
The instrumentation is shown by block diagram in Figure 5. The purpose of each major instrumentation module is shown in Table 1; each major item is identified in Table 2. Table 3 lists the major instrumentation interconnections.

The equipment which ITS had been operating for monitoring RSL on the three 8 GHz links during the previous year were kept in operation for the two month duration of these tests so that a relationship between the long-term flat-fading statistics and the short term in-band fading statistics might be established. On May 26, the strip chart recorder used for RSL measurements failed and was not available in June.

The instrumentation system is very simple in its configuration. An AGC IF amplifier is used to keep power levels constant into the spectrum analyzer in order to prevent rapid flat fading from appearing as amplitude distortion. A complete sweep through the IF spectrum takes a minimum of 1/2 second if the spectrum adjustments are set so that the spectrum analyzer remains in calibrated operation. The settings used during the distortion measurements are shown in Table 4.

Calibration was done once each day on the channels corresponding to the spectrum analyzer, the normalizer and discrete events. Daily operations were as follows:

1. The spectrum analyzer and the normalizer channels were calibrated during a multipath quiet period of the day, usually (1400-1500), and the standard spectral density function envelope was set into the normalizer memory.
2. The recordings were started between 1800 and 2000 and the playback output of each channel was checked to see that all channels were recording properly.



*This diagram shows the instrumentation for the "B" recv.
The one for the "A" recv. is the same design.

Figure 5. Instrumentation used to measure and record selective fading at Mt. Corna.

Table 1. Instrumentation Purposes

Block Diagram No.	Name	Purpose
1	Radio Receiver	Provide long-path radio signal parameters during multipath conditions
2	40 dB Linear Amplifier	Increase the IF level obtained from the sampling point
3	IF Amplifier with AGC	Normalize the spectral density function
4	Spectrum Analyzer	Provide frequency reference (saw-tooth) and the spectral density function envelope
5	20 dB Attenuator	Provide isolation between the Spectrum Analyzers
6	Normalizer	Provide a tool for data checking and editing in the field on the basis of distortion level
7	Marker Signal Generator	Provide a frequency marker for data processing use
8	Potentiometers	Condition signals for compatibility with the magnetic tape recorder
9	DC Amplifier and Zero Offset	Condition signals for compatibility with the magnetic tape recorder
10	Analog Magnetic Tape Recorder	Record the IF Spectrum Envelopes and the various signals associated with amplitude distortion of the spectrum
11	Time Code Generator and Reader	Record "Z" time, for data analysis, checking, and editing purposes
12	Storage Scope	Provide a tool for data checking and editing in the field
13	Pulse Multiplexer	Condition signals for efficient tape channel use
14	Pulse Stretcher	Condition 3-level-error and reframe signals for recording system requirements
15	8-Port Mux	Provide 3-level-error and reframe indicator signals

Table 2. Instrumentation Identification

No.	Name	Mfg. and Model No.	Serial No. "A"	Serial No. "B"
1	Radio Receiver	Collins AN/FRC-165(V)	MTC PAG MTE	019A 010A 011A
2	40 dB Linear Amplifier	Avantek UT8-2211M	12	13
3	IF Amplifier with AGC	Collins 22E4G-MW	741	750
4	Spectrum Analyzer Display IF Sec. RF Sec.	H-P 141T 8552B 8553B	1337A-08018	1320A-05582
5	20 dB Attenuator	Narda		
6	Normalizer	H-P 8750A	946A-02316	2005A 02356
7	Marker Signal Generator	H-P 8640B	1431A02425 (common to A and B)	
8	Potentiometers	NTIA/ITS		
9	DC Amplifiers and Zero Offset	NTIA/ITS		
10	Analog Magnetic Tape Recorders	Honeywell 5600C	102347-FA77	102358-FA77
11	Time Code Gen. and Reader	Datametrics SP-425-A/B	760 (Common to A and B)	
12	Storage Scope	H-P 1744A	1926A00937 (Common to A and B)	
13	Pulse Multiplexer	NTIA/ITS		
14	Pulse Stretcher	NTIA/ITS		
15	8-Port Mux	VICOM AN/FCC-97		

Table 3. Major Instrumentation Interconnections

Name of Signal	Direct-tion	Device	Access Point	Type of Signal	Level Range
70 MHz IF	Output from	"A" or "B" Recv.	22 E4C-MW, IF Amp, 70 MHz Test Jack	IF Spectrum	-40 to -100 dBm
Recv-On-Line	Output from	Recv.	S/L/S Unit, 23P2A-MW, XA2, On Pin 4 ref. to 3	Digital	OVDC - "A" on-line -36VDC - "B" on-line
Recv-Signal-Level	Output from	"A" Recv	S/L/S Unit, 23P2A-MW, XA2, On Pin 9 ref. to Grd.	Analog	-1 VDC- -90 dBm -7 VDC- -30 dBm
Recv-Signal Level	Output from	"B" Recv	S/L/S Unit, 23P2A-MW XA4, On Pin 9 ref. to Grd.	Analog	-1 VDC- -90 dBm -7 VDC- -30 dBm
3-level-errors	Output from	8-Port Mux	4029 Recv Input at error Jack ref. to Grd.	Digital	Event is indicated by a +1.75 VDC Pulse
Main Reframe	Output from	8-Port Mux	4010 PWR & Alarm Unit J9, Pin 7A ref. to Grd.	Digital	Event is indicated by +5VDC Pulse
IF Spec. density Envelope	Output from	Frequency Analyzer	Vertical Output	Envelope of the spectral density function	Approx. 0 to 1 Volt peak to peak Period is 1 second
Saw Tooth	Output from	Frequency Analyzer	scan. In/Out	Ramp 1 Hz	+5 to -5 volts peak-to-peak
70 MHz IF Spec.	Input to	Frequency Analyzer	RF Input	IF Spectrum	Approx. -40 dBm
65 MHz Marker	Input to	Frequency Analyzer	RF Input	65 MHz Sin Wave	-60 dBm
Amplitude Distortion	Output from	Storage Normalizer	X-Y Ploter Y Output	dB difference Between Std. Spec. & Cur. Spec.	6 dB/VDC Period is 1 min.

Table 3. Major Instrumentation Interconnections (continued)

Name of Signal	Direct-tion	Device	Access Point	Type of Signal	Level Range
RSL	Output from	Tape Recorder	Playback Ch 1	Slowly varying Analog Signal Linear in dB	20 dB/Volt, -2.5 VDC = -30 dBm Range = -30 to -90 dBm
Amplitude Distortion	Output from	Tape Recorder	Playback Ch 2	Slowly varying Analog Signal Linear in dB	1 volt change = 15 dB distortion Period = 1 minute*
3-lev-errors & Reframe Events	Output from	Tape Recorder	Playback Ch 3	Discrete Voltage levels (Min. Duration 1 ms)	-1 VDC = no event -0.5 VDC = 3-lev +0.4 VDC = Reframe +1.0 VDC = Both
Spectrum Analyzer Saw-Tooth	Output from	Tape Recorder	Playback Ch 4	Saw Tooth	-1 to +1 volt peak to peak period = 1s*
Spectral Density Envelope	Output from	Tape Recorder	Playback Ch 5	Envelope of the Spectral Density function	0 to 1 volt peak to peak period is 1s*
Time Code	Output from	Tape Recorder	Playback Ch 6	IRIG B	Same levelas the output from the time code gen.
Receiver-On-Line	Output from	Tape Recorder	Playback Ch 7	Two discrete levels	OVDC - "A" on line -1/2 VDC - "B" on line

*Period values for the tape recorder outputs are for 15/16 in/s tape speed.

Table 4. Spectrum Analyzer Setting for Normal Operations

Name of Setting	Value
Frequency	70 MHz
Bandwidth	300 MHz
Scan Width	2 MHz/Div
Input Attenuation	10 dB
Base Clipper "0"	0
Scan Time	0.1 s/Div
Log Ref. Level	-40 dBm
Log Linear Select Switch	-6 dB
Video Filter	100 Hz
Scan Mode	Internal
Scan Trigger	Auto
Writing Speed	Standard

3. Recordings during the night usually lasted from 2000 the previous evening until 0400 the following morning. In a few cases, power outages during the night prematurely terminated the recordings.
4. In the morning, the previous night's recordings were played back at 64 times real time to determine maximum distortion on the tape, 3-level-error or reframe events, and RSL. If the maximum levels of distortion observed were of the same order as routine spectrum variations observed in the communications system (less than 0.2 dB/MHz), the information was noted in the log book and the tapes were erased and reused. If the distortion was significant, the reels were labeled and kept.

The distortion recording channel was used only for field data editing and was not used in the digitized data analysis except as a comparative check.

4. DATA DIGITIZATION AND ANALYSIS

The analog data was sampled and digitized at 200 samples per second per data channel. Each IF spectral density sweep (Table 5) was given a number consisting of the hour, the minute and the sweep within the minute, for example 1 0 34. A number of average values of spectral density corresponding to discrete frequencies within the IF band were calculated for each spectral density sweep (see Table 5). This table shows values before normalizing them by subtracting them from standard sweep values. These values were obtained by averaging samples in the neighborhoods corresponding to the various frequencies. Of the 200 samples per second digitized from the spectrum sweep channel, 100 were ignored due to the 1/2 second period between sweeps. Of the remaining 100, only the even numbered samples were saved leaving 50. The first 9 and the last 9 of these samples were ignored in order that the analysis would be made on the more slowly changing part of the spectral density function. The remaining 32 samples were grouped into sets of 4 which were averaged to provide 8 points corresponding to each spectral density function sweep. In order to calculate distortion values from the data, it was necessary to determine a set of points representing a standard spectral density function. This standard was usually selected by printing out the sets of points representing the sweeps from the first minute of each hour. From these values a set of points representing the standard sweep was derived for each day's data.

The selection of the points representing the standard sweep was found to have a pronounced influence on the distortion values calculated. If a standard sweep had a slope bias, of course all the distortion values were biased by that amount. More importantly, however, the noise on the standard sweep adds substantially to the

Table 5. Typical Spectral Density Representation

Start time - 29 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 0 0 0
Distortion Threshold : Div= 0.00 dB/MHz Pri= 0.00 dB MHz

Sweep No.	Diversity Receiver Spectral---Density---Distortion----(dB) 67.7	68.5	69.3	70.0	70.7	71.4	72.2	72.9	RSL	3levl Error Event	Ref Frame Event	Rcvr on Line	Primary Receiver Spectral---Density---Distortion----(dB) 67.7	68.5	69.3	70.0	70.7	71.4	72.2	72.9	RSL
1 0 2	.9	2.3	3.3	4.2	4.6	4.7	3.8	2.0	-54.1	0	0	D	.2	2.1	3.3	4.7	5.3	5.3	4.5	2.9	-50.5
1 0 3	.9	2.3	3.3	4.2	4.9	4.6	3.7	2.1	-54.5	0	0	D	.3	2.1	3.6	4.5	5.4	5.4	4.6	2.8	-49.8
1 0 4	.9	2.2	3.2	4.2	4.6	4.7	3.8	2.0	-55.0	0	0	D	.4	2.2	3.6	4.6	5.2	5.6	4.5	2.8	-49.8
1 0 5	.7	2.2	3.4	4.1	4.7	4.7	3.7	2.1	-55.4	0	0	D	.3	2.1	3.6	4.6	5.5	5.4	4.6	2.9	-50.3
1 0 6	.8	2.1	3.2	4.1	4.7	4.6	3.8	1.9	-55.4	0	0	D	.4	2.2	3.6	4.6	5.3	5.4	4.5	2.8	-50.0
1 0 7	.7	2.0	3.1	4.2	4.6	4.7	3.7	2.1	-55.4	0	0	D	.1	2.2	3.4	4.6	5.3	5.4	4.5	2.9	-49.8
1 0 8	.5	1.9	3.2	4.0	4.5	4.7	3.6	2.0	-55.9	0	0	D	.2	2.3	3.4	4.6	5.4	5.5	4.5	3.1	-49.6
1 0 9	.6	2.0	3.2	4.0	4.6	4.6	3.8	1.8	-56.8	0	0	D	.3	2.2	3.5	4.5	5.3	5.4	4.5	3.0	-49.6
1 0 10	.3	1.8	3.2	4.0	4.6	4.6	3.5	1.8	-57.3	0	0	D	.2	2.2	3.6	4.6	5.3	5.4	4.4	2.8	-49.8
1 0 11	.3	1.9	3.3	3.9	4.5	4.3	3.5	1.6	-57.3	0	0	D	.3	2.3	3.6	4.7	5.3	5.4	4.7	2.9	-48.9
1 0 12	.4	2.0	3.0	4.0	4.5	4.4	3.6	1.8	-57.7	0	0	D	.4	2.2	3.6	4.5	5.3	5.3	4.5	2.8	-49.1
1 0 13	.2	1.8	3.1	4.0	4.4	4.4	3.6	1.9	-57.7	0	0	D	.3	2.2	3.6	4.6	5.4	5.3	4.5	2.8	-48.4
1 0 14	.4	2.0	3.1	3.8	4.4	4.5	3.5	1.7	-57.7	0	0	D	.4	2.3	3.4	4.7	5.3	5.1	4.4	2.8	-48.4
1 0 15	.2	1.9	3.0	3.7	4.4	4.2	3.6	1.7	-58.6	0	0	D	.4	2.3	3.6	4.7	5.2	5.3	4.6	2.6	-48.2
1 0 16	.3	1.9	3.1	3.9	4.4	4.5	3.5	1.8	-57.7	0	0	D	.3	2.2	3.6	4.4	5.3	5.4	4.6	2.8	-48.7
1 0 17	.4	2.1	3.1	4.0	4.6	4.4	3.5	1.7	-58.2	0	0	D	.6	2.4	3.6	4.7	5.1	5.1	4.6	2.7	-48.9
1 0 18	.5	1.9	3.1	4.0	4.6	4.4	3.7	1.8	-5[illegible].3	0	0	D	.4	2.1	3.5	4.5	5.2	5.4	4.5	2.8	-48.7
1 0 19	.5	2.1	3.0	4.0	4.6	4.5	3.4	1.7	-5[illegible].3	0	0	D	.4	2.3	3.5	4.7	5.4	5.3	4.5	2.9	-48.4
1 0 20	.6	2.3	3.0	4.1	4.4	4.5	3.5	1.9	-57.3	0	0	D	.4	2.2	3.4	4.5	5.1	5.3	4.5	2.9	-48.7
1 0 21	.7	2.2	3.2	4.1	4.5	4.6	3.6	1.9	-57.3	0	0	D	.4	2.3	3.5	4.6	5.2	5.4	4.5	2.7	-48.0
1 0 22	.5	2.3	3.1	4.2	4.6	4.4	3.7	1.7	-57.3	0	0	D	.6	2.3	3.7	4.5	5.3	5.6	4.4	2.9	-47.8
1 0 23	.8	2.0	3.1	4.1	4.6	4.4	3.6	1.8	-56.4	0	0	D	.5	2.2	3.6	4.4	5.4	5.4	4.6	2.9	-47.8
1 0 24	.5	1.9	3.2	4.0	4.6	4.4	3.7	1.9	-56.4	0	0	D	.5	2.4	3.6	4.6	5.3	5.4	4.6	2.8	-47.5
0 25	.8	2.2	3.2	4.0	4.6	4.6	3.6	1.8	-55.9	0	0	D	.2	2.4	3.6	4.6	5.3	5.2	4.5	2.8	-47.1
0 26	.8	2.3	3.3	4.1	4.8	4.6	3.7	1.8	-55.4	0	0	D	.4	2.2	3.6	4.8	5.5	5.2	4.5	2.7	-47.1
1 0 27	.7	2.1	3.2	4.0	4.8	4.6	3.4	1.9	-56.4	0	0	D	.4	2.4	3.6	4.6	5.1	5.5	4.4	2.8	-47.3
1 0 28	.5	2.1	3.1	4.1	4.6	4.4	3.4	1.8	-56.8	0	0	D	.5	2.4	3.5	4.6	5.2	5.3	4.6	2.6	-47.5
1 0 29	.7	2.7	3.1	4.1	4.6	4.4	3.4	1.5	-56.8	0	0	D	.5	2.4	3.5	4.5	5.2	5.3	4.5	2.9	-47.3
1 0 30	.7	2.0	3.0	4.0	4.4	4.3	3.6	1.6	-56.8	0	0	D	.5	2.4	3.6	4.6	5.3	5.3	4.5	2.8	-46.8
1 0 31	.7	2.2	3.1	3.9	4.4	4.4	3.6	1.8	-56.8	0	0	D	.4	2.3	3.7	4.6	5.2	5.4	4.4	2.7	-47.1
1 0 32	.9	2.3	3.1	4.1	4.6	4.5	3.6	1.9	-56.4	0	0	D	.3	2.2	3.4	4.5	5.4	5.2	4.5	2.8	-47.3
1 0 33	.7	2.3	3.3	4.1	4.7	4.5	3.4	2.1	-56.4	0	0	D	.6	2.3	3.6	4.6	5.2	5.4	4.8	2.8	-47.3
1 0 34	.8	2.2	3.3	4.3	4.8	4.8	3.7	1.9	-55.4	0	0	D	.3	2.2	3.5	4.6	5.4	5.3	4.5	2.8	-47.1
1 0 35	.8	2.2	3.5	4.1	4.7	4.5	3.8	2.1	-54.1	0	0	D	.4	2.3	3.5	4.6	5.3	5.3	4.5	2.6	-46.8
1 0 36	1.0	2.3	3.3	4.2	4.8	4.6	3.7	1.9	-54.1	0	0	D	.5	2.3	3.7	4.6	5.3	5.4	4.6	2.8	-46.6
1 0 37	1.0	2.6	3.5	4.1	4.7	4.6	3.8	2.0	-54.1	0	0	D	.6	2.4	3.6	4.5	5.1	5.4	4.5	2.9	-46.4
1 0 38	.9	2.5	3.5	4.3	4.9	4.8	3.8	2.0	-53.2	0	0	D	.5	2.5	3.6	4.6	5.3	5.2	4.4	2.9	-46.8
1 0 39	.9	2.4	3.4	4.3	4.9	4.8	3.7	2.0	-52.7	0	0	D	.4	2.3	3.5	4.6	5.3	5.4	4.3	2.8	-46.6
1 0 40	.9	2.3	3.4	4.2	4.8	4.6	3.9	2.2	-51.8	0	0	D	.4	2.4	3.7	4.5	5.4	5.3	4.4	2.8	-46.4
1 0 41	1.3	2.5	3.4	4.2	4.9	4.6	3.8	2.3	-52.3	0	0	D	.5	2.4	3.6	4.6	5.4	5.2	4.4	2.8	-46.2
1 0 42	1.2	2.5	3.5	4.3	4.6	4.7	3.8	2.2	-51.8	0	0	D	.7	2.3	3.5	4.6	5.2	5.3	4.5	2.9	-45.7
1 0 43	1.0	2.4	3.6	4.2	4.8	4.5	3.8	2.0	-51.3	0	0	D	.6	2.3	3.6	4.6	5.3	5.4	4.4	2.5	-45.5
1 0 44	1.0	2.4	3.4	4.2	5.0	4.8	3.8	2.0	-51.3	0	0	D	.6	2.2	3.5	4.7	5.2	5.4	4.6	2.8	-45.0
1 0 45	1.1	2.6	3.3	4.3	5.0	4.7	3.8	2.2	-51.8	0	0	D	.6	2.4	3.5	4.6	5.1	5.4	4.3	2.9	-44.8
1 0 46	1.3	2.6	3.4	4.2	4.7	4.8	4.0	2.1	-50.4	0	0	D	.4	2.5	3.5	4.7	5.3	5.3	4.3	2.8	-44.8
1 0 47	1.3	2.6	3.4	4.4	4.8	4.7	3.9	2.2	-49.5	0	0	D	.7	2.4	3.7	4.4	5.3	5.2	4.4	2.8	-43.9
1 0 48	1.3	2.5	3.7	4.5	4.8	4.8	3.9	2.2	-48.6	0	0	D	.6	2.5	3.8	4.5	5.4	5.2	4.5	2.8	-43.9

range of apparent distortion. This effect was investigated by obtaining time distributions of distortion using several sweep value sets as standards. One effect observed was the creation of a narrow vacant zone of distortion values that appears at times in the correlation plots. Similar vacant zones were also caused by digitizing status programming error. Each sweep was normalized by subtracting it from the standard sweep. From this set of differences, a minimum value was selected from the differences corresponding to the two edge frequencies (67.7 and 72.9 MHz). A maximum value was obtained from the other difference values for the sweep. The difference between maximum and minimum was then divided by the corresponding differences in frequencies to yield the distortion in dB/MHz.

Minimum values of RSL (Table 5) were collected during each spectral density sweep period. In order to convert RSL into fade depth below the long-term median, each RSL value was subtracted from the long-term median RSL value.

If 3-level error events (format violations) or reframe events occurred during a sweep period, the events were counted and stored in correspondence with the sweep. The receiver-on-line status (primary or diversity receiver) was also stored with each sweep. The status at the end of the sweep was stored as being the receiver-on-line. From these values of distortion, fade depth, 3-level-error events, and reframe events, the distributions and correlation functions were obtained which are presented in the results section.

5. RESULTS

Approximately 50 hours of recordings were returned to the ITS Boulder laboratories for analysis. Of the 50 hours, approximately half were for quiet hours showing no significant distortion or fading. Since careful editing of each channel was necessary after digitizing the data in order to eliminate data anomalies caused by software and hardware, 15 hours of data analysis are presented here. This data includes the hours of deepest multipath fading observed during the total recording period. The results are presented in terms of time distributions of amplitude distortion, flat fading, distortion event durations and intervals between events. Four hours of the flat fading and amplitude distortion are presented as time functions. Correlation plots of flat fading and amplitude distortion are also presented. All of this information is presented in Figures 6 through 20 and Tables 6 through 41.

The results are presented in three sections. Each section represents five hours of data. The first section is for a period of heavy fading; the second section is for a period of moderate fading and the third is for a period of light fading. Onc

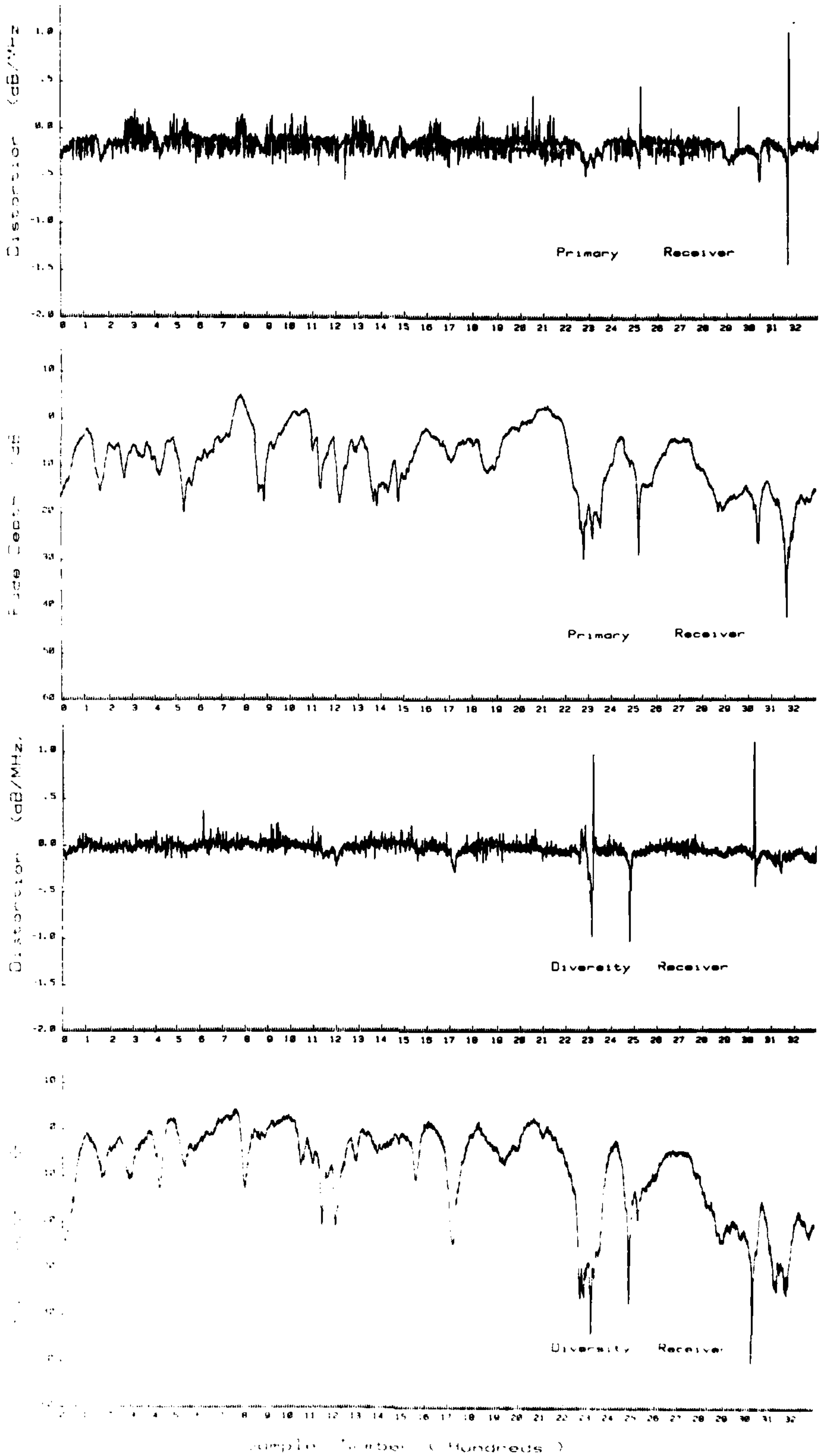


Figure 6. Fade depth distortion comparison for time period of 29 May 1980, 0100-0200, Mt. Venda to Mt. Corna.

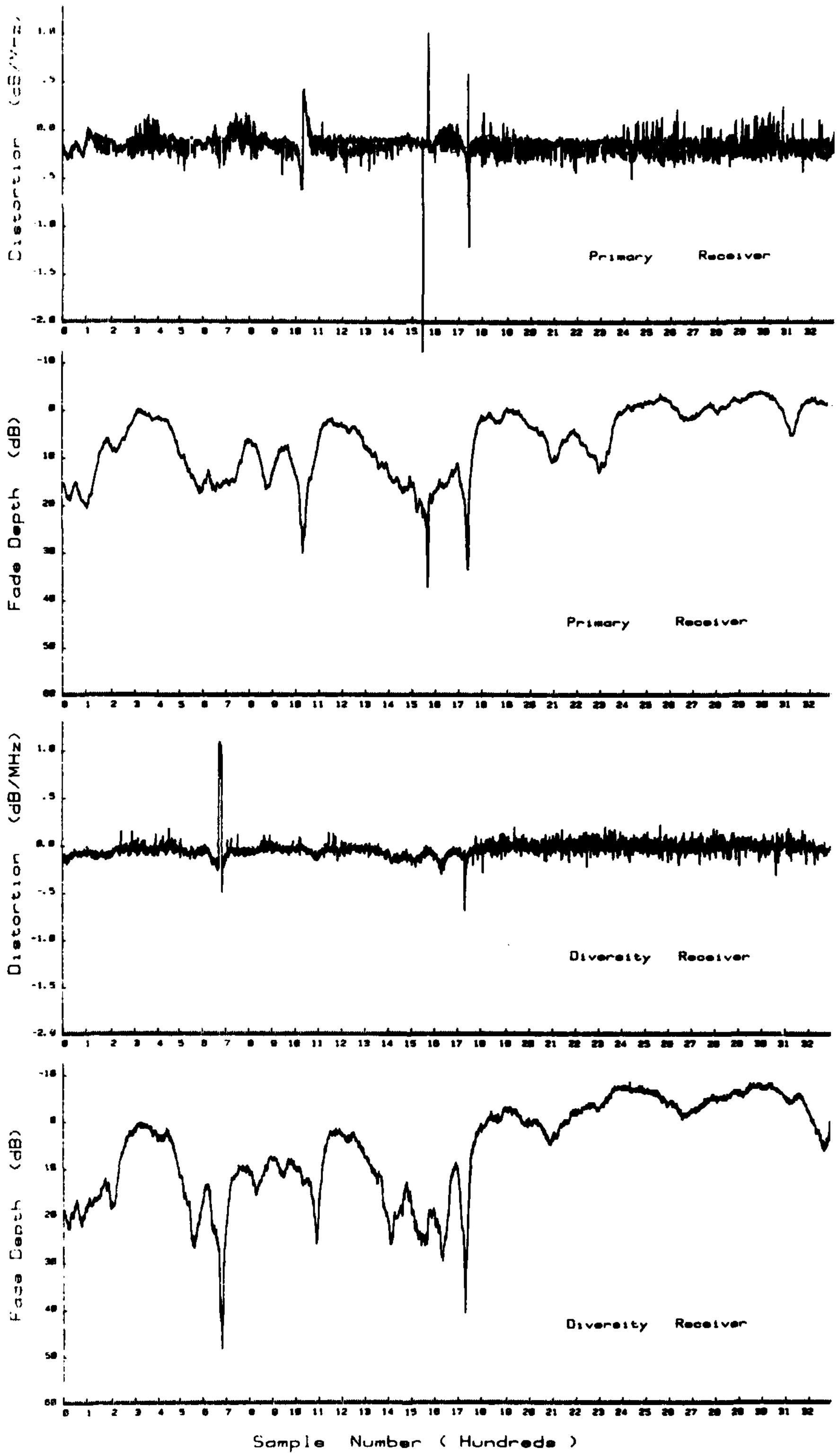


Figure 7. Fade depth distortion comparison for time period of 29 May 1980, 0200-0300, Mt. Venda to Mt. Corna.

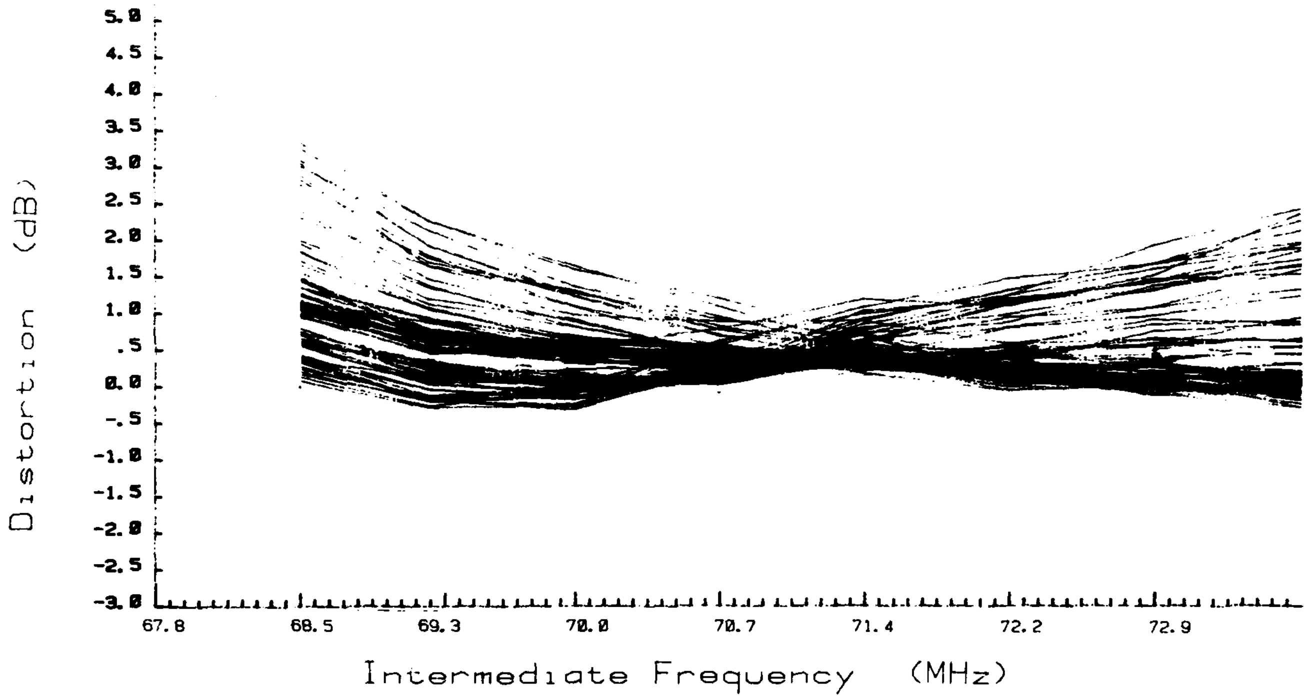


Figure 8. Differences between reference sweep and the sweep value from May 29, 02-18-10 to 02-19-20.

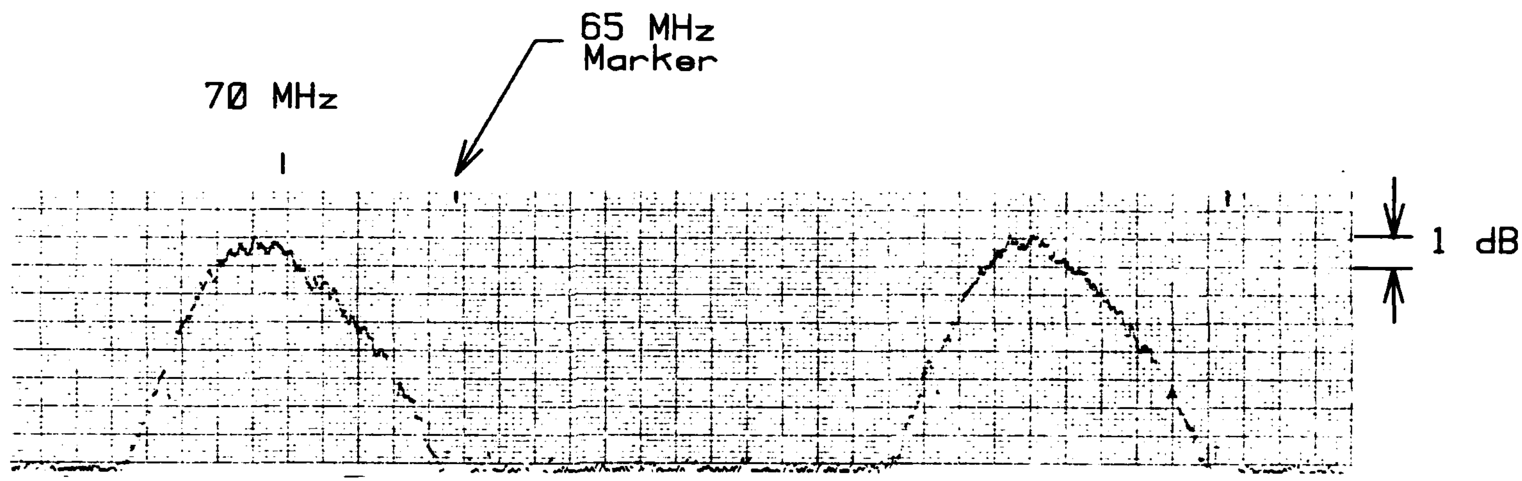


Figure 9. Typical analog representation of the IF spectral density function.

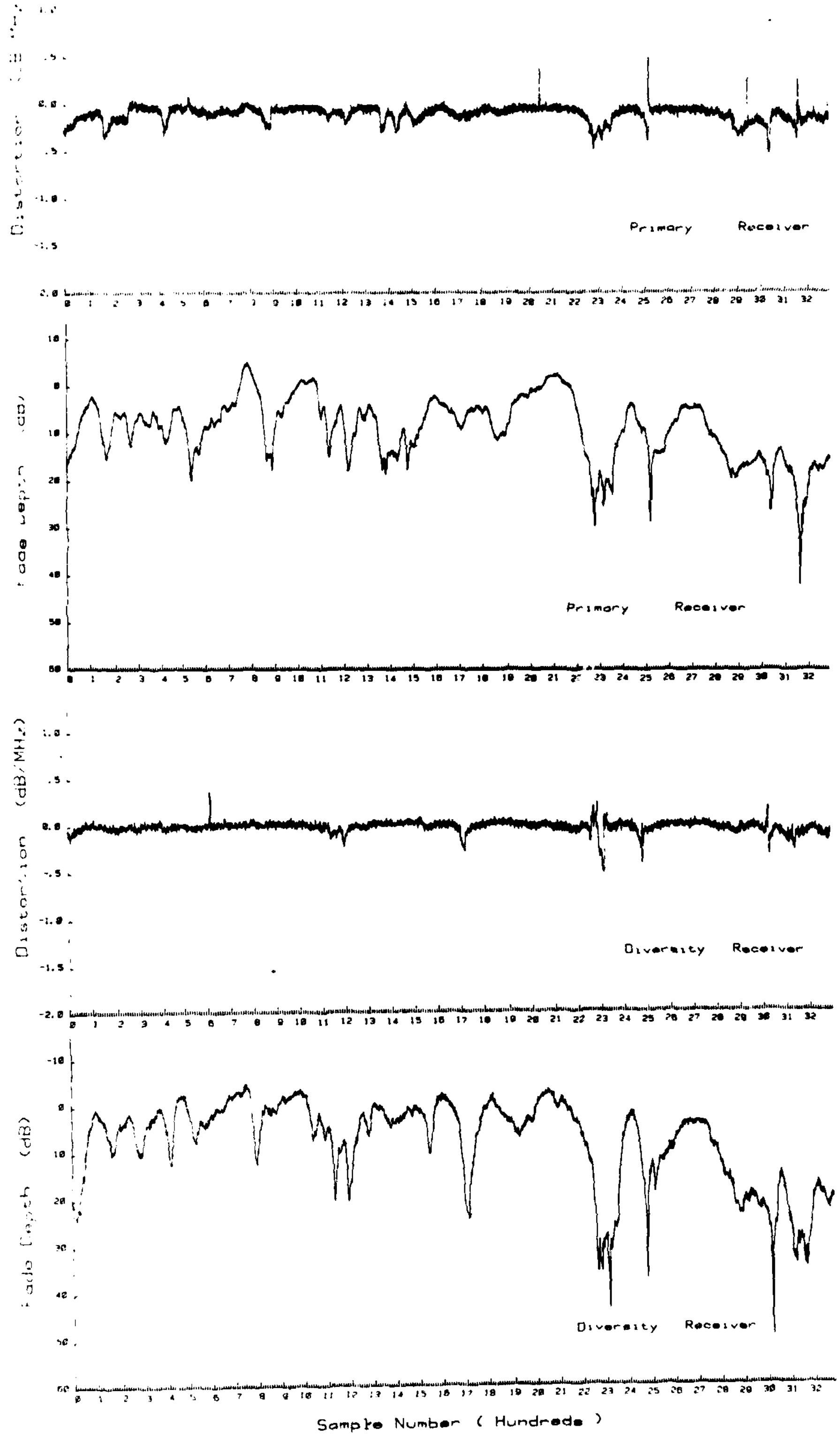


Figure 10. Fade Depth Distortion Comparison (Slopes only) for time period of 29 May 1980, 0100-0200, Mt. Venda to Mt. Corna.

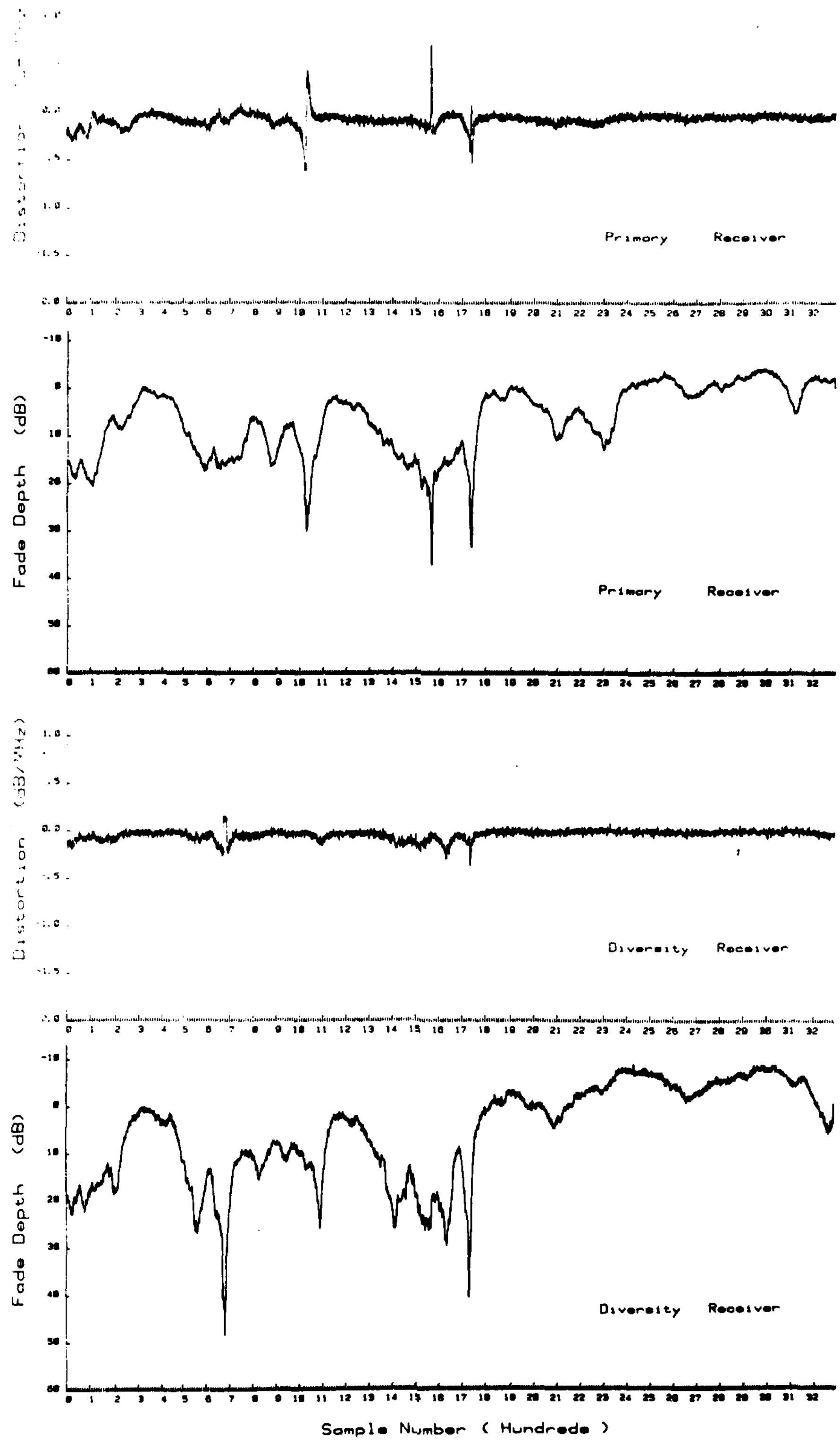


Figure 11. Fade Depth Distortion Comparison (Slopes only) for time period of 29 May 1980, 0200-0300, Mt. Venda to Mt. Corna.

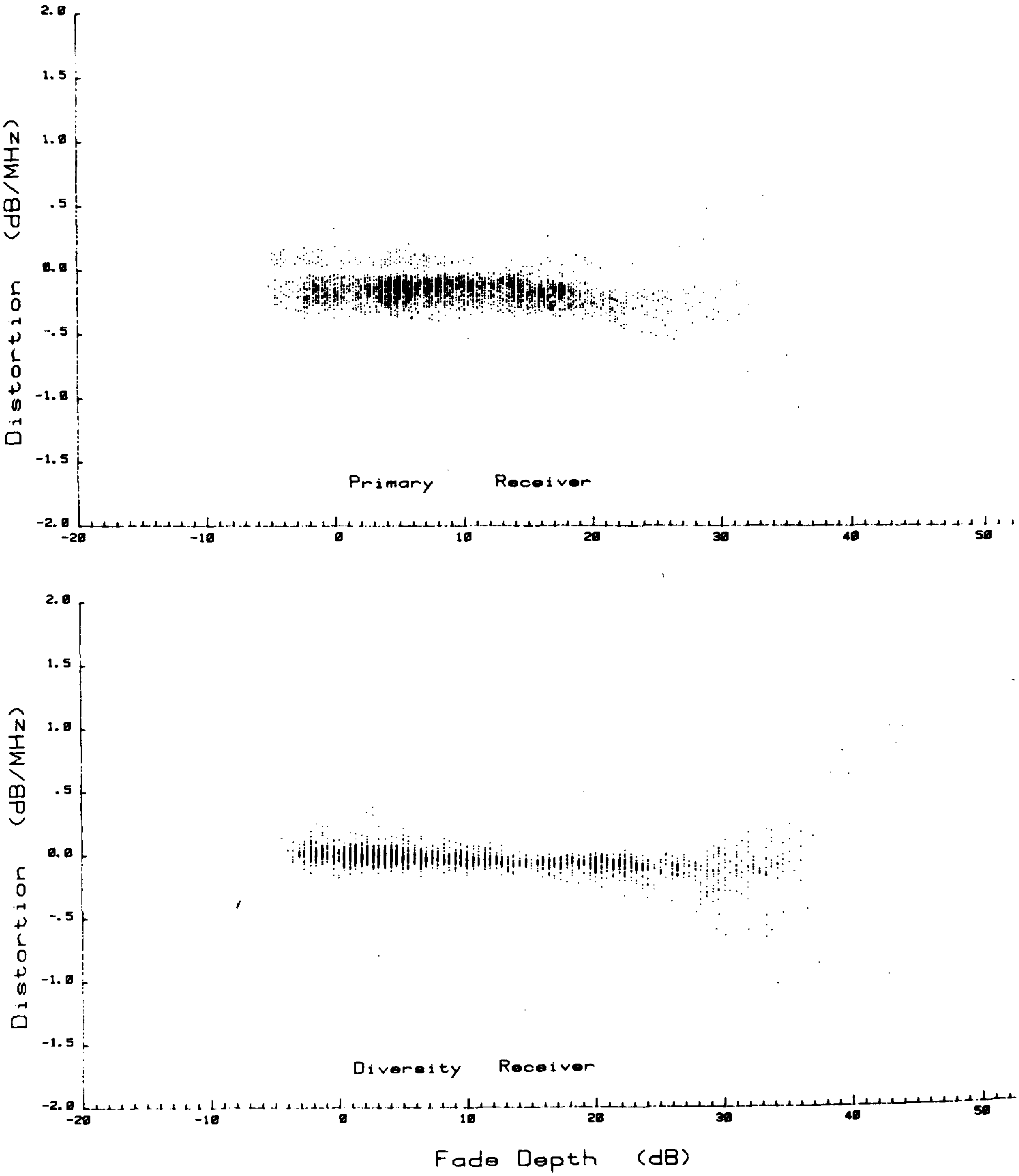


Figure 12. Correlation of spectrum amplitude distortion to fade depth for 29 May 1980, 0100-0200, Mt. Venda to Mt. Corna.

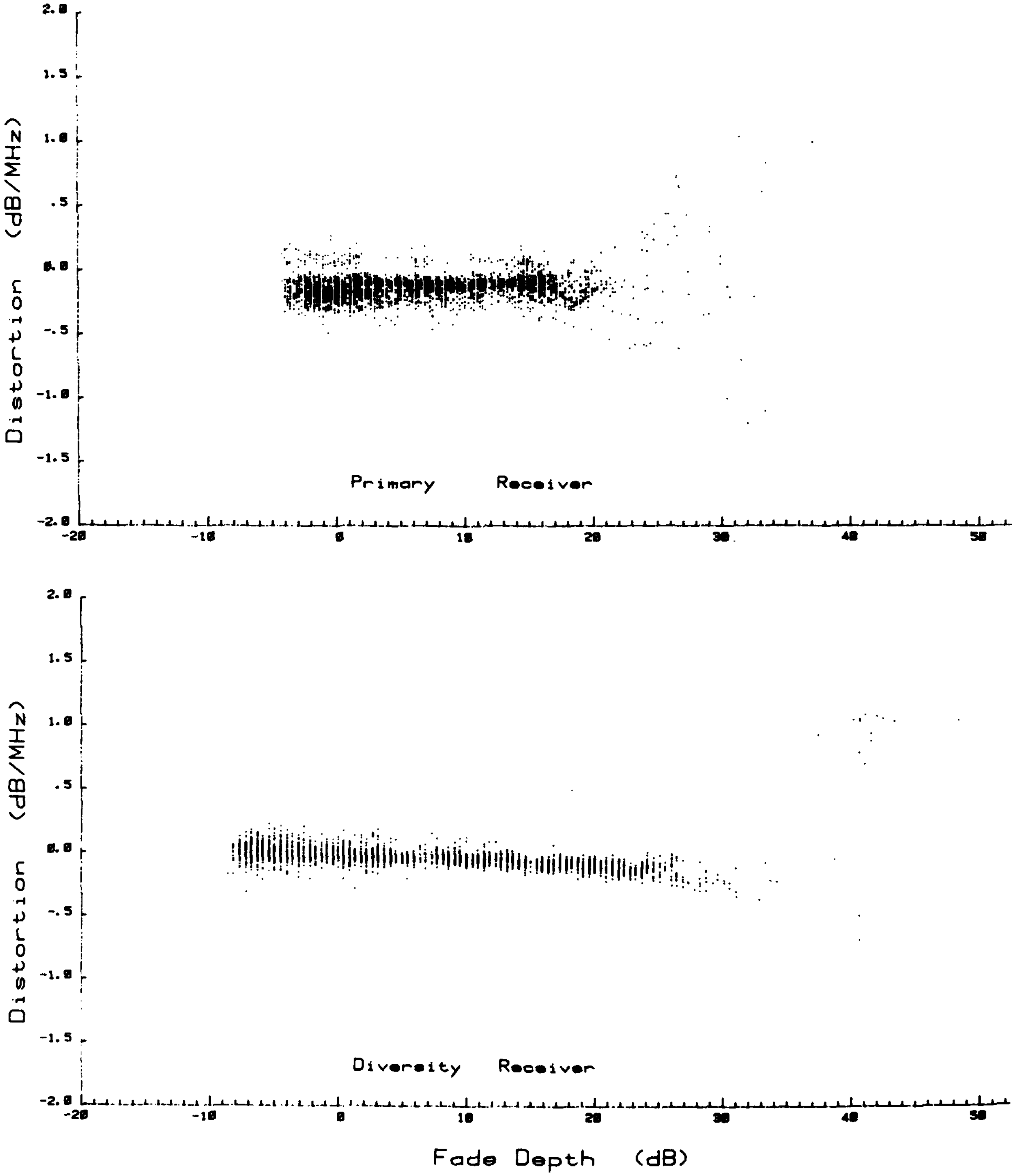


Figure 13. Correlation of spectrum amplitude distortion to fade depth for 29 May 1980, 0200-0300, Mt. Venda to Mt. Corna.

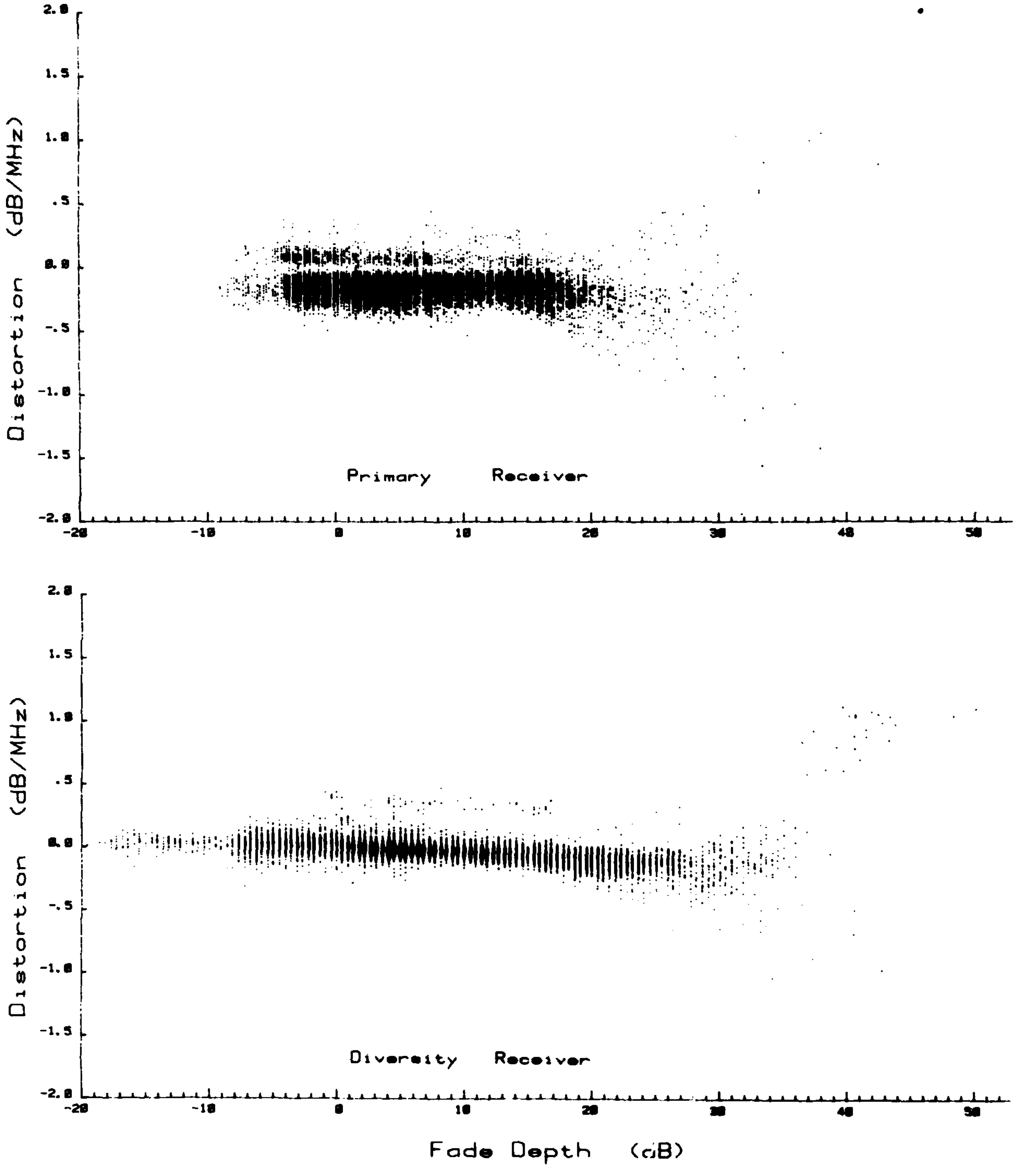


Figure 14. Correlation of spectrum amplitude distortion to fade depth for 28-29 May 1980, 2300-0400, Mt. Venda to Mt. Corna.

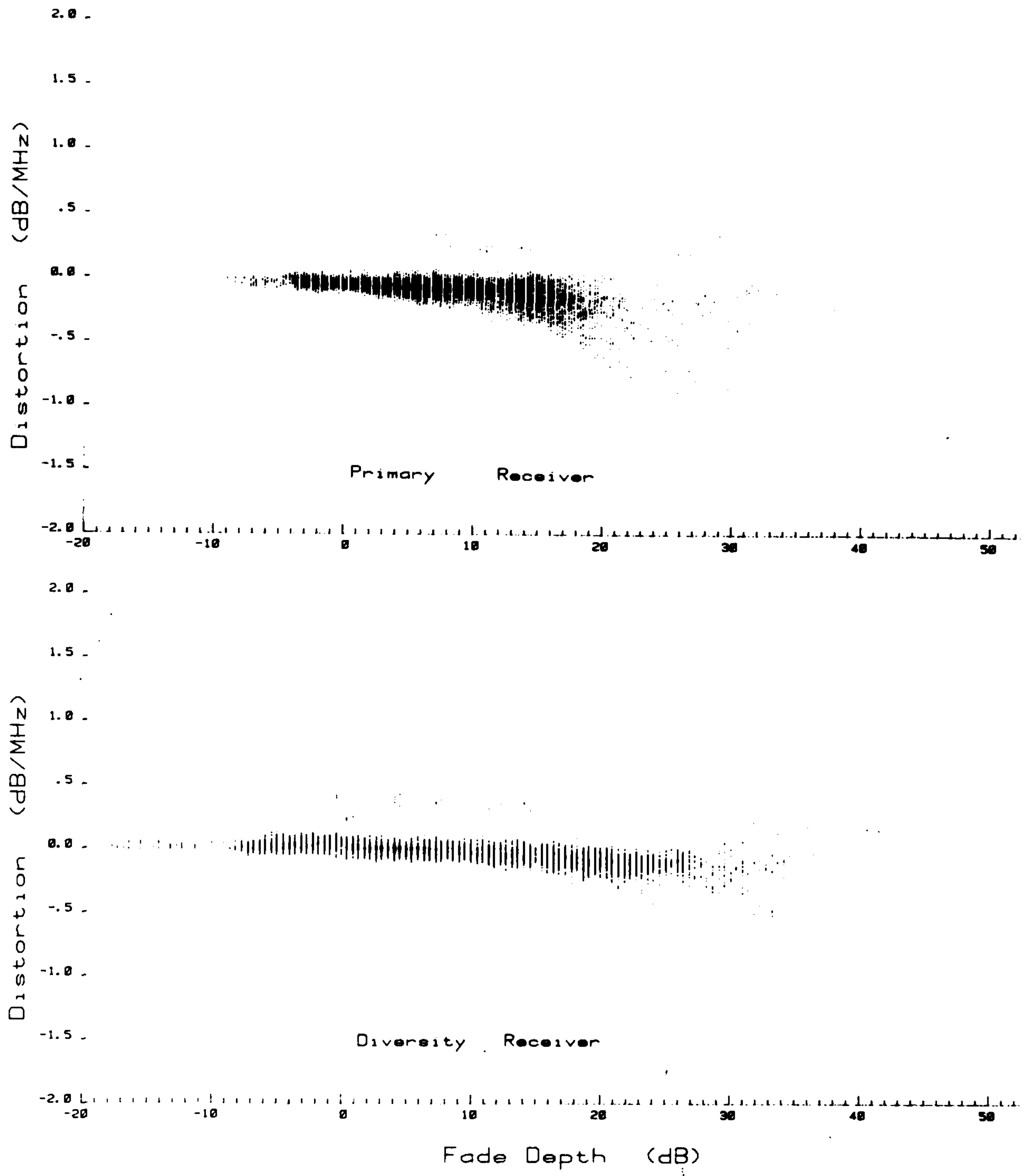


Figure 15. Correlation of spectrum amplitude distortion (slopes only) to fade depth for 28-29 May 1980. 2300-0400. Mt. Venda to Mt. Corna.

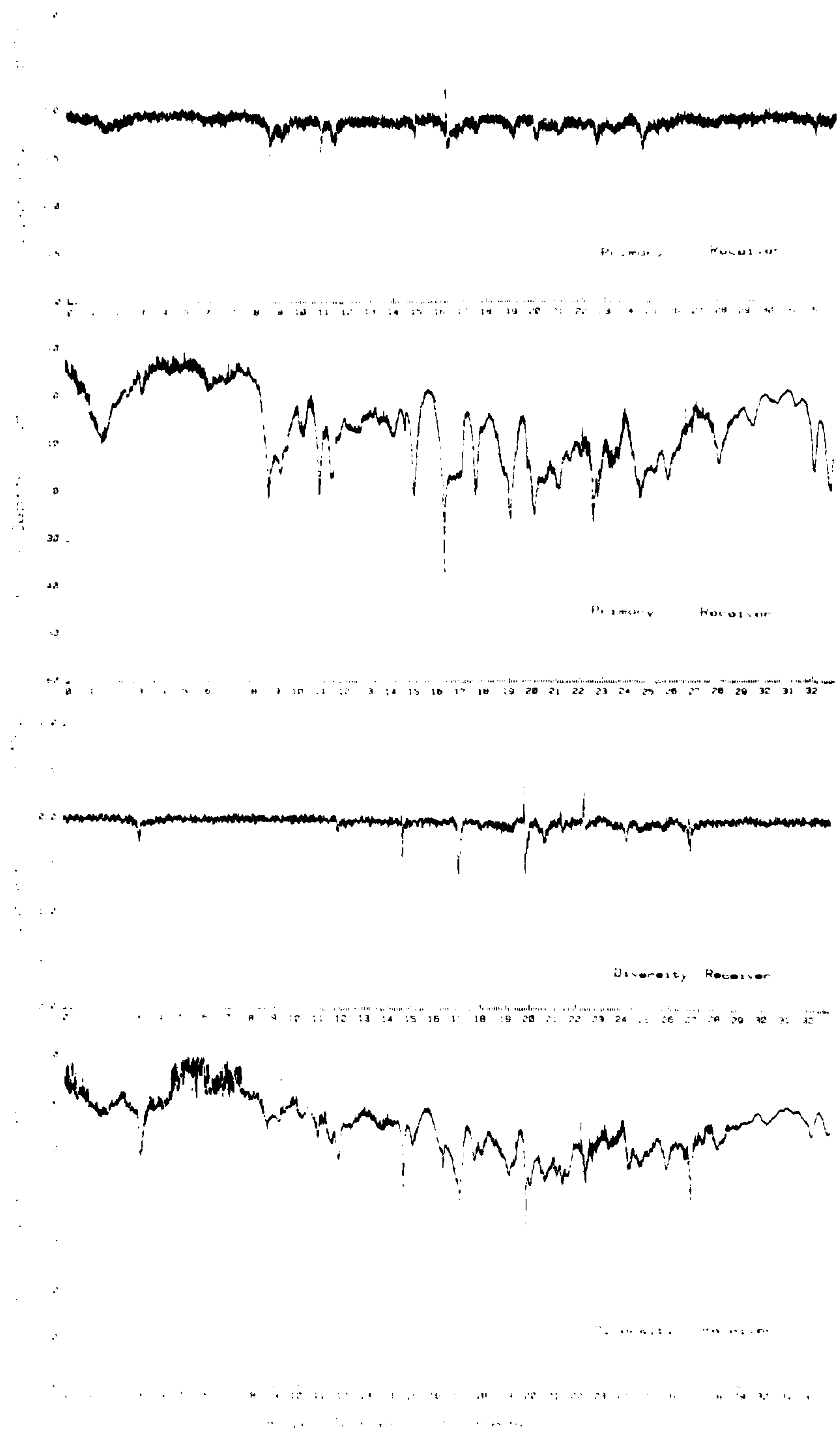


Figure 16. Fade Depth Distortion Comparison (Slopes only) for time period of 13 May 1980, 0100-0200, Mt. Venda to Mt. Corna.

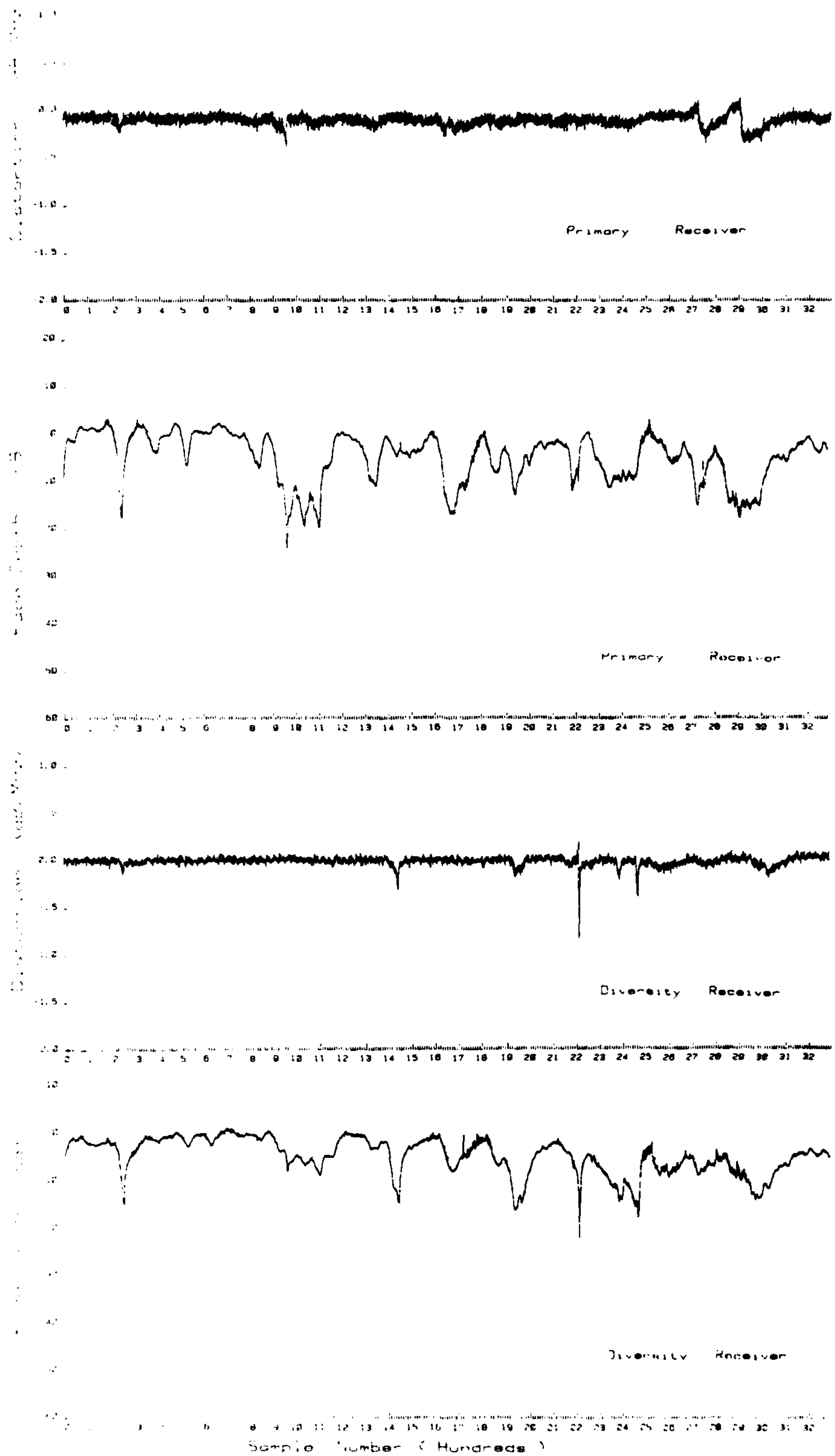


Figure 17. Fade Depth Distortion Comparison (Slopes only) for time period of 13 May 1980, 0200-0300, Mt. Venda to Mt. Corna.

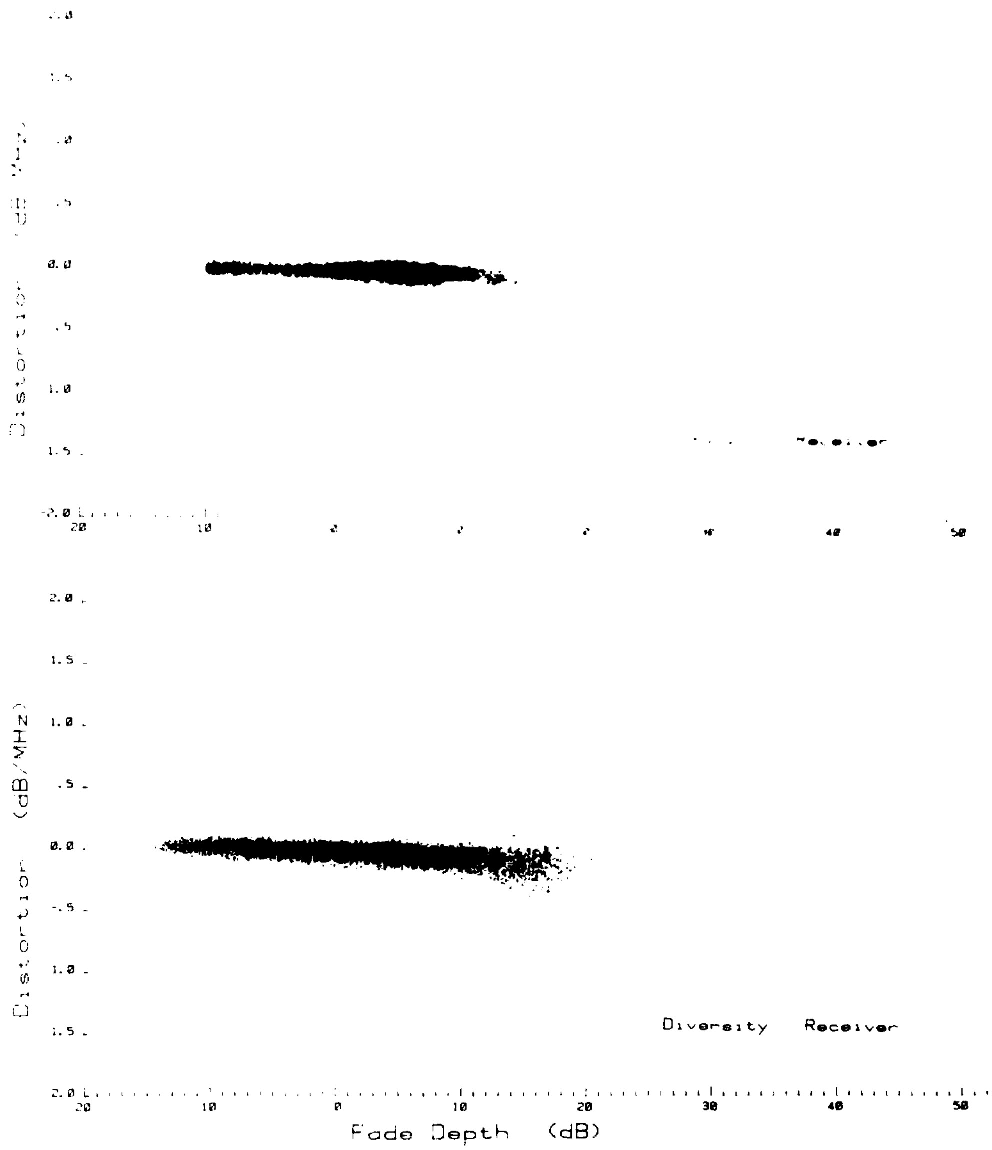


Figure 18. Correlation of spectrum amplitude distortion to fade depth for slopes only, 12-13 May 1980, 2300-0400, Mt. Venda to Mt. Corna.

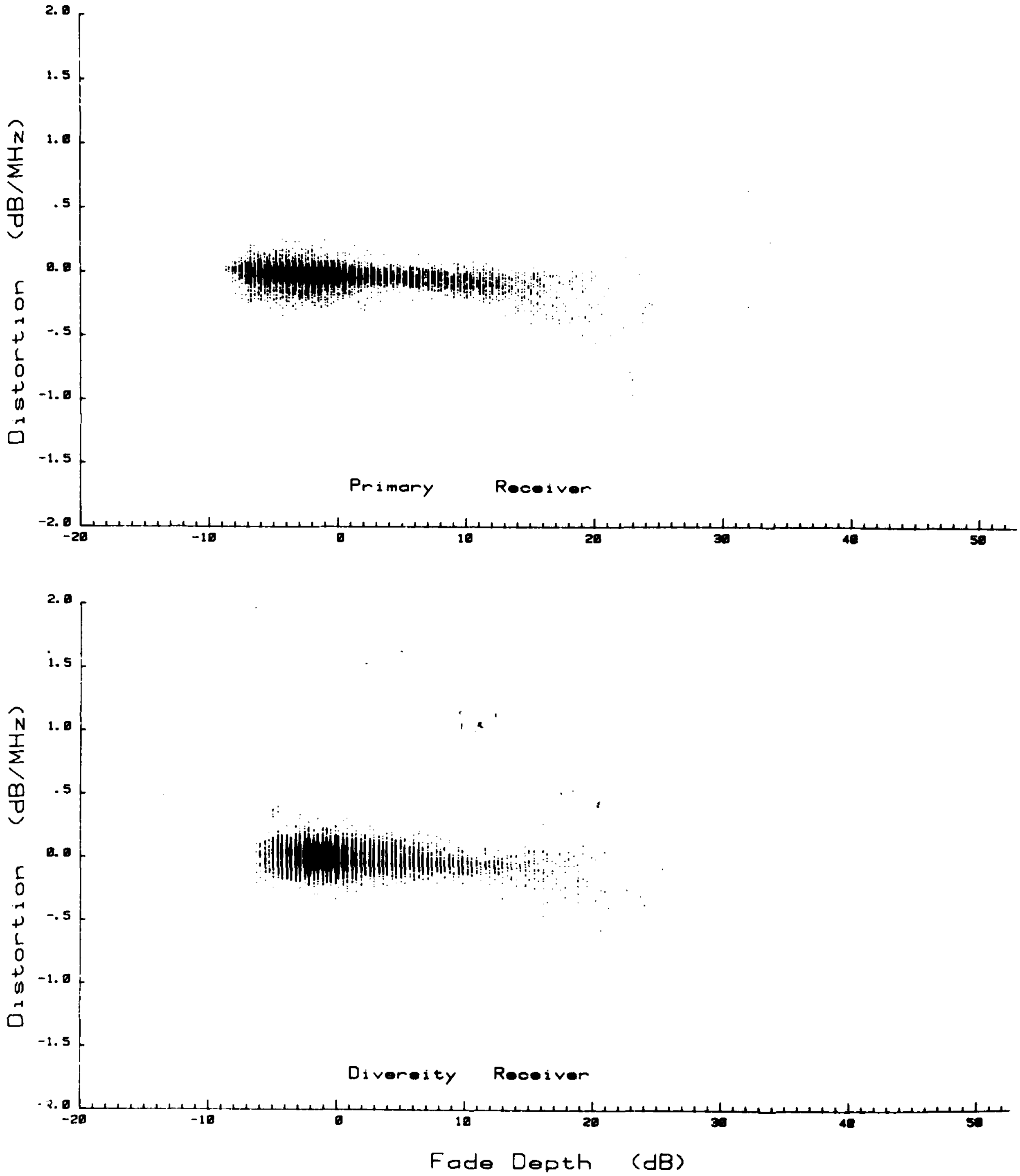


Figure 19. Correlation of spectrum amplitude distortion to fade depth for 13-14 May 1980, 2200-0300, Mt. Venda to Mt. Corna.

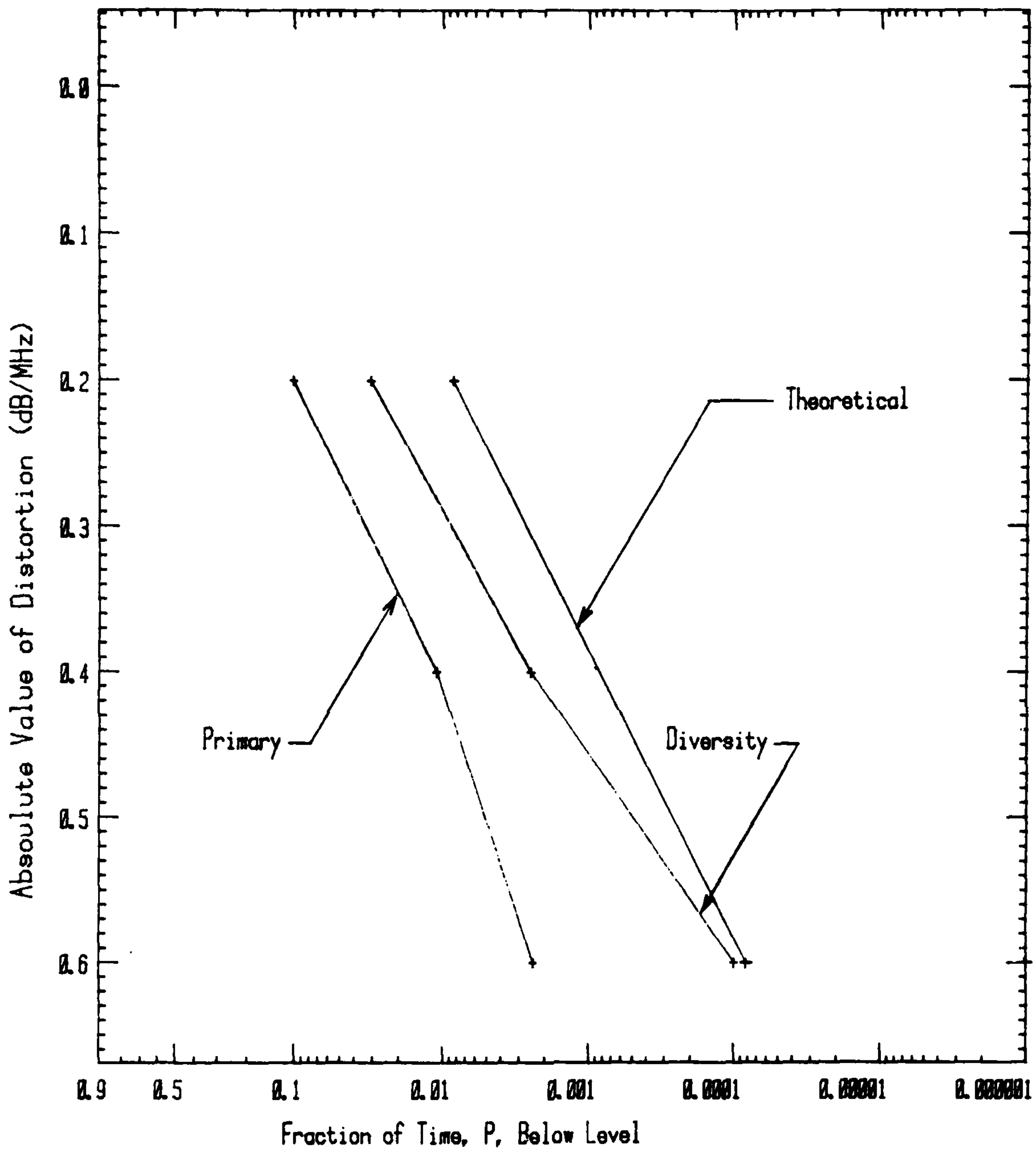


Figure 20. Cumulative distortion distribution (slopes only), Venda-Corna, 28-29 May 1980, 2300-0400 hours.

Table 6. Cumulative Distortion Distribution For 29 May 1980, 2300-0400. Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 24 8 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	116	261	377	.0228	5	8725	.5288
	.4	39	26	65	.0039	10	5248	.3181
	.6	26	9	35	.0021	15	2938	.1781
	.8	22	3	25	.0015	20	1503	.0911
	1.0	12	1	13	.0008	25	477	.0289
	1.2			0	0.0000	30	159	.0096
	1.4			0	0.0000	35	42	.0025
	1.6			0	0.0000	40	21	.0013
	1.8			0	0.0000	45	2	0.0000
	2.0			0	0.0000	50	1	0.0000
Primary								
	.2	84	3994	4078	.2472	5	9438	.5720
	.4	12	113	125	.0076	10	4643	.2814
	.6	6	26	32	.0019	15	1885	.1143
	.8	5	12	17	.0010	20	296	.0179
	1.0	3	9	12	.0007	25	99	.0060
	1.2		5	5	.0003	30	29	.0018
	1.4		4	4	.0002	35	6	.0004
	1.6		2	2	.0001	40	1	.0001
	1.8		2	2	.0001	45		0.0000
	2.0		1	1	.0001	50		0.0000
Recv.-On line								
	.2	3	625	628	.0381	5	2458	.1490
	.4		27	27	.0016	10	1560	.0945
	.6		4	4	.0002	15	613	.0372
	.8			0	0.0000	20	97	.0059
	1.0			0	0.0000	25	16	.0010
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 7. Cumulative Distortion Distribution For 28 May 1980, 2300-2400, Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 24 8 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity	.2	67	46	113	.0342	5	1832	.5612
	.4	17	4	21	.0064	10	1056	.3200
	.6	5	1	6	.0018	15	483	.1464
	.8	4		4	.0012	20	233	.0706
	1.0	1		1	.0003	25	68	.0206
	1.2			0	0.0000	30	18	.0055
	1.4			0	0.0000	35	5	.0015
	1.6			0	0.0000	40	1	.0003
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary	.2	14	537	551	.1670	5	1970	.5970
	.4	1	3	4	.0012	10	830	.2518
	.6			0	0.0000	15	204	.0618
	.8			0	0.0000	20	5	.0015
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line	.2	3	325	328	.0994	5	1178	.3570
	.4			0	0.0000	10	610	.1848
	.6			0	0.0000	15	173	.0524
	.8			0	0.0000	20	1	.0003
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 8. Cumulative Distortion Distribution For 29 May 1980, 0000-0100, Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 24 8 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	7	37	44	.0133	5	2234	.6770
	.4	1	5	6	.0018	10	1348	.4085
	.6			0	0.0000	15	605	.1833
	.8			0	0.0000	20	235	.0712
	1.0			0	0.0000	25	43	.0130
	1.2			0	0.0000	30	6	.0018
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	4	783	787	.2385	5	2164	.6558
	.4		59	59	.0179	10	1224	.3709
	.6		15	15	.0045	15	465	.1409
	.8		6	6	.0018	20	55	.0167
	1.0		3	3	.0009	25	18	.0055
	1.2		2	2	.0006	30	5	.0015
	1.4		2	2	.0006	35		0.0000
	1.6		1	1	.0003	40		0.0000
	1.8		1	1	.0003	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		106	106	.0321	5	615	.1864
	.4		7	7	.0021	10	490	.1485
	.6		3	3	.0009	15	207	.0627
	.8			0	0.0000	20	22	.0067
	1.0			0	0.0000	25	2	.0006
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 9. Cumulative Distortion Distribution For 29 May 1980, 0100-0200, Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 24 8 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the − Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	16	71	87	.0264	5	1618	.4903
	.4	7	15	22	.0067	10	1037	.3142
	.6	7	7	14	.0042	15	753	.2282
	.8	5	3	8	.0024	20	515	.1561
	1.0	2	1	3	.0009	25	235	.0712
	1.2			0	0.0000	30	107	.0324
	1.4			0	0.0000	35	20	.0061
	1.6			0	0.0000	40	5	.0015
	1.8			0	0.0000	45	1	.0003
	2.0			0	0.0000	50	1	.0003
Primary								
	.2	9	988	997	.3021	5	2259	.6845
	.4	4	18	22	.0067	10	1300	.3939
	.6	2	4	6	.0018	15	628	.1903
	.8	2	2	4	.0012	20	156	.0473
	1.0	1	2	3	.0009	25	52	.0158
	1.2		1	1	.0003	30	13	.0039
	1.4		1	1	.0003	35	5	.0015
	1.6			0	0.0000	40	1	.0003
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		133	133	.0403	5	307	.0930
	.4		9	9	.0027	10	235	.0712
	.6			0	0.0000	15	158	.0479
	.8			0	0.0000	20	65	.0197
	1.0			0	0.0000	25	13	.0039
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 10. Cumulative Distortion Distribution For 29 May 1980, 0200-0300, Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 24 8 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	17	50	67	.0203	5	1453	.4403
	.4	14	2	16	.0048	10	1166	.3533
	.6	14	1	15	.0045	15	723	.2191
	.8	13		13	.0039	20	384	.1164
	1.0	9		9	.0027	25	110	.0333
	1.2			0	0.0000	30	28	.0085
	1.4			0	0.0000	35	17	.0052
	1.6			0	0.0000	40	15	.0045
	1.8			0	0.0000	45	1	.0003
	2.0			0	0.0000	50		0.0000
Primary								
	.2	21	807	828	.2509	5	1665	.5045
	.4	7	24	31	.0094	10	1061	.3215
	.6	4	7	11	.0033	15	544	.1648
	.8	3	4	7	.0021	20	80	.0242
	1.0	2	4	6	.0018	25	28	.0085
	1.2		2	2	.0006	30	11	.0033
	1.4		1	1	.0003	35	1	.0003
	1.6		1	1	.0003	40		0.0000
	1.8		1	1	.0003	45		0.0000
	2.0		1	1	.0003	50		0.0000
Recv.-On line								
	.2		61	61	.0185	5	358	.1085
	.4		11	11	.0033	10	225	.0682
	.6		1	1	.0003	15	75	.0227
	.8			0	0.0000	20	9	.0027
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 11. Cumulative Distortion Distribution For 29 May 1980, 0300-0400, Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 24 8 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	9	57	66	.0200	5	1568	.4752
	.4			0	0.0000	10	641	.1942
	.6			0	0.0000	15	374	.1133
	.8			0	0.0000	20	136	.0412
	1.0			0	0.0000	25	21	.0064
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	36	879	915	.2773	5	1380	.4182
	.4		9	9	.0027	10	228	.0691
	.6			0	0.0000	15	44	.0133
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2			0	0.0000	5		0.0000
	.4			0	0.0000	10		0.0000
	.6			0	0.0000	15		0.0000
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 12. Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 8, Mt. Venda to Mt. Corna, 28-29 May 1980

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400	.2	0	2388	1.0000	0	2391	1.0000
		1	627	.2626	1	1756	.7344
		2	214	.0896	2	1359	.5684
		4	64	.0268	4	839	.3509
		8	33	.0138	8	396	.1656
		16	17	.0071	16	124	.0519
		32	6	.0025	32	29	.0121
		64	3	.0013	64	2	.0008
		128			128		
		256			256		
		512			512		
		1024			1024		
		2048			2048		
2300-400	.4	0	39	1.0000	0	39	1.0000
		1	16	.4103	1	37	.9487
		2	12	.3077	2	35	.8974
		4	8	.2051	4	33	.8462
		8	5	.1282	8	32	.8205
		16			16	31	.7949
		32			32	27	.6923
		64			64	27	.6923
		128			128	24	.6154
		256			256	16	.4103
		512			512	9	.2308
		1024			1024	4	.1026
		2048			2048	2	.0513

Table 12. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 8, Mt. Venda to Mt. Corna, 28-29 May 1980

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	.6	0	9	1.0000	0	9	1.0000
		1	5	.5556	1	9	1.0000
		2	5	.5556	2	9	1.0000
		4	3	.3333	4	8	.8889
		8	1	.1111	8	8	.8889
		16			16	8	.8889
		32			32	7	.7778
		64			64	7	.7778
		128			128	6	.6667
		256			256	5	.5556
		512			512	5	.5556
		1024			1024	4	.4444
		2048			2048	3	.3333
2300-400							
	.8	0	6	1.0000	0	6	1.0000
		1	4	.6667	1	6	1.0000
		2	4	.6667	2	6	1.0000
		4	1	.1667	4	6	1.0000
		8			8	6	1.0000
		16			16	6	1.0000
		32			32	5	.8333
		64			64	5	.8333
		128			128	4	.6667
		256			256	3	.5000
		512			512	3	.5000
		1024			1024	3	.5000
		2048			2048	2	.3333

Table 12. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 3, Mt. Venda to Mt. Corna, 28-29 May 1980

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	1.0	0	5	1.0000	0	5	1.0000
		1	4	.8000	1	5	1.0000
		2	3	.6000	2	5	1.0000
		4			4	5	1.0000
		8			8	5	1.0000
		16			16	5	1.0000
		32			32	4	.8000
		64			64	4	.6000
		128			128	4	.8000
		256			256	3	.6000
		512			512	3	.6000
		1024			1024	3	.6000
		2048			2048	2	.4000
2300-400							
	1.2	0	4	1.0000	0	4	1.0000
		1	1	.2500	1	4	1.0000
		2			2	4	1.0000
		4			4	4	1.0000
		8			8	4	1.0000
		16			16	4	1.0000
		32			32	4	1.0000
		64			64	4	1.0000
		128			128	4	1.0000
		256			256	3	.7500
		512			512	3	.7500
		1024			1024	3	.7500
		2048			2048	2	.5000

Table 12 (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 8, Mt. Venda to Mt. Corna, 28-29 May 1980

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	1.4	0	3	1.0000	0	3	1.0000
		1	1	.3333	1	3	1.0000
		2			2	3	1.0000
		4			4	3	1.0000
		8			8	3	1.0000
		16			16	3	1.0000
		32			32	3	1.0000
		64			64	3	1.0000
		128			128	3	1.0000
		256			256	3	1.0000
		512			512	3	1.0000
		1024			1024	3	1.0000
		2048			2048	2	.6667
2300-400							
	1.6	0	2	1.0000	0	2	1.0000
		1			1	2	1.0000
		2			2	2	1.0000
		4			4	2	1.0000
		8			8	2	1.0000
		16			16	2	1.0000
		32			32	2	1.0000
		64			64	2	1.0000
		128			128	2	1.0000
		256			256	2	1.0000
		512			512	2	1.0000
		1024			1024	2	1.0000
		2048			2048	2	1.0000

Table 13. Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 24 8, Mt. Venda to Mt. Corna, 28-29 May 1980

	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	.2	0	125	1.0000	0	125	1.0000
		1	44	.3520	1	103	.8240
		2	31	.2480	2	91	.7280
		4	23	.1840	4	80	.6400
		8	10	.0800	8	72	.5760
		16	4	.0320	16	64	.5120
		32			32	58	.4640
		64			64	55	.4400
		128			128	40	.3200
		256			256	24	.1920
		512			512	9	.0720
		1024			1024		
		2048			2048		
2300-400							
	.4	0	20	1.0000	0	20	1.0000
		1	11	.5500	1	16	.8000
		2	7	.3500	2	16	.8000
		4	3	.1500	4	16	.8000
		8	2	.1000	8	14	.7000
		16			16	14	.7000
		32			32	14	.7000
		64			64	14	.7000
		128			128	13	.6500
		256			256	11	.5500
		512			512	8	.4000
		1024			1024	3	.1500
		2048			2048	1	.0500

Table 13. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 24 8, Mt. Venda to Mt. Corna, 28-29 May 1980

	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	.6	0	9	1.0000	0	9	1.0000
		1	6	.6667	1	9	1.0000
		2	5	.5556	2	9	1.0000
		4	2	.2222	4	8	.8889
		8	1	.1111	8	8	.8889
		16			16	8	.8889
		32			32	8	.8889
		64			64	8	.8889
		128			128	8	.8889
		256			256	7	.7778
		512			512	7	.7778
		1024			1024	3	.3333
		2048			2048	1	.1111
2300-400							
	.8	0	8	1.0000	0	8	1.0000
		1	7	.8750	1	6	.7500
		2	3	.3750	2	6	.7500
		4	2	.2500	4	6	.7500
		8			8	6	.7500
		16			16	6	.7500
		32			32	6	.7500
		64			64	6	.7500
		128			128	6	.7500
		256			256	5	.6250
		512			512	5	.6250
		1024			1024	3	.3750
		2048			2048	1	.1250

Table 13. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 24 8, Mt. Venda to Mt. Corna, 28-29 May 1980

	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	1.0	0	7	1.0000	0	7	1.0000
		1	4	.5714	1	4	.5714
		2	2	.2857	2	4	.5714
		4			4	4	.5714
		8			8	4	.5714
		16			16	4	.5714
		32			32	4	.5714
		64			64	4	.5714
		128			128	4	.5714
		256			256	4	.5714
		512			512	4	.5714
		1024			1024	2	.2857
		2048			2048	1	.1429
2300-400							
	1.2	0			0		
		1			1		
		2			2		
		4			4		
		8			8		
		16			16		
		32			32		
		64			64		
		128			128		
		256			256		
		512			512		
		1024			1024		
		2048			2048		

Table 14. Cumulative Distortion Distribution (slopes only) For 28-29 May 1980 2300-0400, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 24 8

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	59	452	511	.0319	5	8725	.5288
	.4	1	41	42	.0025	10	5248	.3181
	.6		2	2	.0001	15	2938	.1781
	.8			0	0.0000	20	1503	.0911
	1.0			0	0.0000	25	477	.0289
	1.2			0	0.0000	30	159	.0096
	1.4			0	0.0000	35	42	.0025
	1.6			0	0.0000	40	21	.0013
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	51	1628	1679	.1018	5	9438	.5720
	.4	4	183	187	.0113	10	4643	.2814
	.6	1	38	39	.0024	15	1885	.1142
	.8		11	11	.0007	20	296	.0179
	1.0		4	4	.0002	25	99	.0060
	1.2		2	2	.0001	30	29	.0018
	1.4			0	0.0000	35	6	.0004
	1.6			0	0.0000	40	1	.0001
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2	1	431	432	.0262	5	2458	.1490
	.4		52	52	.0032	10	1560	.0945
	.6		14	14	.0008	15	613	.0372
	.8		3	3	.0002	20	97	.0059
	1.0			0	0.0000	25	16	.0010
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 15. Cumulative Distortion Distribution (slopes only) For 28 May 1980 2300-2400, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 24 8

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	49	80	129	.0391	5	1852	.5612
	.4	1	3	4	.0012	10	1056	.3200
	.6			0	0.0000	15	483	.1464
	.8			0	0.0000	20	233	.0706
	1.0			0	0.0000	25	68	.0206
	1.2			0	0.0000	30	18	.0055
	1.4			0	0.0000	35	5	.0015
	1.6			0	0.0000	40	1	.0003
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	5	208	213	.0645	5	1970	.5970
	.4	1	9	10	.0030	10	830	.2515
	.6		1	1	.0003	15	204	.0618
	.8			0	0.0000	20	5	.0015
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2	1	186	187	.0567	5	1178	.3570
	.4		5	5	.0015	10	610	.1848
	.6			0	0.0000	15	173	.0524
	.8			0	0.0000	20	1	.0003
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 16. Cumulative Distortion Distribtuion (slopes only) For 29 May 1980 0000-0100, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 24 8

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	3	57	60	.0182	5	2234	.6770
	.4		13	13	.0039	10	1348	.4085
	.6			0	0.0000	15	605	.1833
	.8			0	0.0000	20	235	.0712
	1.0			0	0.0000	25	43	.0130
	1.2			0	0.0000	30	6	.0018
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	1	401	402	.1218	5	2164	.6558
	.4		91	91	.0276	10	1224	.3709
	.6		26	26	.0079	15	465	.1409
	.8		11	11	.0033	20	55	.0167
	1.0		4	4	.0012	25	18	.0055
	1.2		2	2	.0006	30	5	.0015
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		72	72	.0218	5	615	.1864
	.4		10	10	.0030	10	490	.1485
	.6		5	5	.0015	15	207	.0627
	.8		3	3	.0009	20	22	.0067
	1.0			0	0.0000	25	2	.0006
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 17. Cumulative Distortion Distribution (slopes only) For 29 May 1980 0100-0200, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 24 8

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	4	107	111	.0336	5	1618	.4903
	.4		20	20	.0061	10	1037	.3143
	.6		2	2	.0006	15	753	.2282
	.8			0	0.0000	20	515	.1561
	1.0			0	0.0000	25	235	.0712
	1.2			0	0.0000	30	107	.0324
	1.4			0	0.0000	35	20	.0061
	1.6			0	0.0000	40	5	.0015
	1.8			0	0.0000	45	1	.0003
	2.0			0	0.0000	50	1	.0003
Primary								
	.2	5	652	657	.1991	5	2259	.6845
	.4	1	51	52	.0158	10	1300	.3939
	.6		3	3	.0009	15	628	.1903
	.8			0	0.0000	20	156	.0473
	1.0			0	0.0000	25	52	.0158
	1.2			0	0.0000	30	13	.0039
	1.4			0	0.0000	35	5	.0015
	1.6			0	0.0000	40	1	.0003
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		130	130	.0394	5	307	.0930
	.4		21	21	.0064	10	235	.0712
	.6		3	3	.0009	15	158	.0479
	.8			0	0.0000	20	65	.0197
	1.0			0	0.0000	25	13	.0039
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 18. Cumulative Distortion Distribution (slopes only) For 29 May 1980 0200-0300, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 24 8

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity	.2		90	90	.0273	5	1453	.4403
	.4		2	2	.0006	10	1166	.3533
	.6			0	0.0000	15	723	.2191
	.8			0	0.0000	20	384	.1164
	1.0			0	0.0000	25	110	.0333
	1.2			0	0.0000	30	28	.0085
	1.4			0	0.0000	35	17	.0052
	1.6			0	0.0000	40	15	.0045
	1.8			0	0.0000	45	1	.0003
	2.0			0	0.0000	50		0.0000
Primary	.2	15	226	241	.0730	5	1665	.5045
	.4	2	23	25	.0076	10	1061	.3215
	.6	1	8	9	.0027	15	544	.1648
	.8			0	0.0000	20	80	.0242
	1.0			0	0.0000	25	28	.0085
	1.2			0	0.0000	30	11	.0033
	1.4			0	0.0000	35	1	.0003
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line	.2		43	43	.0130	5	358	.1085
	.4		16	16	.0048	10	225	.0682
	.6		6	6	.0018	15	75	.0227
	.8			0	0.0000	20	9	.0027
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 19. Cumulative Distortion Distribution (slopes only) For 29 May 1980 0300-0400, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 24 8

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	3	118	121	.0367	5	1568	.4752
	.4		3	3	.0009	10	641	.1942
	.6			0	0.0000	15	374	.1133
	.8			0	0.0000	20	136	.0412
	1.0			0	0.0000	25	21	.0064
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	25	141	166	.0503	5	1380	.4182
	.4		9	9	.0027	10	228	.0691
	.6			0	0.0000	15	44	.0133
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2			0	0.0000	5		0.0000
	.4			0	0.0000	10		0.0000
	.6			0	0.0000	15		0.0000
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 20. Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 8, Slopes Only

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-300							
	.2	0	359	1.0000	0	361	1.0000
		1	154	.4290	1	221	.6122
		2	93	.2591	2	169	.4681
		4	55	.1532	4	118	.3269
		8	37	.1031	8	84	.2327
		16	25	.0696	16	70	.1939
		32	10	.0279	32	54	.1496
		64	4	.0111	64	45	.1247
		128	1	.0028	128	35	.0970
		256			256	18	.0499
		512			512	3	.0083
		1024			1024	1	.0028
		2048			2048		
2300-300							
	.4	0	44	1.0000	0	44	1.0000
		1	27	.6136	1	35	.7955
		2	18	.4091	2	33	.7500
		4	11	.2500	4	26	.5909
		8	6	.1364	8	23	.5227
		16	3	.0682	16	20	.4545
		32			32	18	.4091
		64			64	17	.3864
		128			128	15	.3409
		256			256	10	.2273
		512			512	8	.1818
		1024			1024	6	.1364
		2048			2048	2	.0455

Table 20. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 8, Slopes Only

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-300	.6	0	14	1.0000	0	14	1.0000
		1	5	.3571	1	11	.7857
		2	3	.2143	2	11	.7857
		4	3	.2143	4	10	.7143
		8	1	.0714	8	10	.7143
		16			16	10	.7143
		32			32	9	.6429
		64			64	7	.5000
		128			128	7	.5000
		256			256	6	.4286
		512			512	6	.4286
		1024			1024	4	.2857
		2048			2048	3	.2143
2300-300	.8	0	3	1.0000	0	3	1.0000
		1	2	.6667	1	2	.6667
		2	2	.6667	2	2	.6667
		4	1	.3333	4	2	.6667
		8			8	2	.6667
		16			16	2	.6667
		32			32	2	.6667
		64			64	2	.6667
		128			128	1	.3333
		256			256	1	.3333
		512			512	1	.3333
		1024			1024	1	.3333
		2048			2048	1	.3333

Table 20. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 1 24 8, Slopes Only

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-300							
	1.0	0	2	1.0000	0	2	1.0000
		1	1	.5000	1	2	1.0000
		2	1	.5000	2	2	1.0000
		4			4	2	1.0000
		8			8	2	1.0000
		16			16	2	1.0000
		32			32	2	1.0000
		64			64	2	1.0000
		128			128	1	.5000
		256			256	1	.5000
		512			512	1	.5000
		1024			1024	1	.5000
		2048			2048	1	.5000
2300-300							
	1.2	0	1	1.0000	0	1	1.0000
		1	1	1.0000	1	1	1.0000
		2			2	1	1.0000
		4			4	1	1.0000
		8			8	1	1.0000
		16			16	1	1.0000
		32			32	1	1.0000
		64			64	1	1.0000
		128			128	1	1.0000
		256			256	1	1.0000
		512			512	1	1.0000
		1024			1024	1	1.0000
		2048			2048	1	1.0000

Table 21. Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 24 8, Slopes Only

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-300							
	.2	0	169	1.0000	0	169	1.0000
		1	73	.4320	1	117	.6923
		2	51	.3018	2	93	.5503
		4	28	.1657	4	69	.4083
		8	12	.0710	8	60	.3550
		16	7	.0414	16	42	.2485
		32			32	37	.2189
		64			64	32	.1893
		128			128	25	.1479
		256			256	18	.1065
		512			512	11	.0651
		1024			1024	2	.0118
		2048			2048	1	.0059
2300-300							
	.4	0	15	1.0000	0	15	1.0000
		1	6	.4000	1	12	.8000
		2	4	.2667	2	12	.8000
		4	2	.1333	4	12	.8000
		8	2	.1333	8	11	.7333
		16			16	11	.7333
		32			32	11	.7333
		64			64	11	.7333
		128			128	11	.7333
		256			256	10	.6667
		512			512	10	.6667
		1024			1024	4	.2667
		2048			2048	2	.1333

Table 21. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 24 8, Slopes Only

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-300	.6	0	2	1.0000	0	2	1.0000
		1			1	2	1.0000
		2			2	2	1.0000
		4			4	1	.5000
		8			8	1	.5000
		16			16	1	.5000
		32			32	1	.5000
		64			64	1	.5000
		128			128	1	.5000
		256			256	1	.5000
		512			512	1	.5000
		1024			1024	1	.5000
		2048			2048	1	.5000
2300-300	.8	0			0		
		1			1		
		2			2		
		4			4		
		8			8		
		16			16		
		32			32		
		64			64		
		128			128		
		256			256		
		512			512		
		1024			1024		
		2048			2048		

Table 22. Event Occurrences during the 28-29 May 2300-0400 Data Period

Start time - 28 May 1980 2300hr   Standard Spectral Density Sweep No. 1 24 8
Path - Mt. Venda to Mt. Corna   Distortion Threshold : Div= 0.00 dB/MHz Pri= 0.00 dB MHz

Sweep No.	Diversity Receiver Distortion (dB/MHz) Minumum		Maximum		Distortion	Fade(dB)	3levl Error Event	Ref-rame Event	Rcvr on Line	Primary Receiver Distortion (dB/MHz) Minimum		Maximum		Distortion	Fade(dB)
23 27 46	2.5	67.7	2.8	72.9	.07	26.0	1	0	D	-.7	72.9	-.1	67.7	-.11	7.6
23 27 47	4.1	67.7	6.4	71.4	.61	37.0	0	0	P	-.8	72.9	-.2	67.7	-.12	8.9
23 59 18	3.9	67.7	4.3	72.9	.08	33.3	1	1	P	-.7	72.9	-.0	67.7	-.13	16.7
0 12 15	-.2	72.9	.0	67.7	-.05	22.4	0	0	D	-.9	72.9	3.5	67.7	-.85	29.8
0 18 38	1.3	72.9	3.1	67.7	-.36	31.0	3	0	D	-.8	72.9	.2	67.7	-.20	17.6
0 18 40	.9	72.9	2.8	67.7	-.36	30.6	1	0	D	-.9	72.9	.2	67.7	-.22	17.9
1 41 21	2.3	67.7	3.2	72.9	.18	31.9	1	0	D	-.3	72.9	1.2	67.7	-.29	23.3
1 41 38	2.4	67.7	2.9	72.9	.09	33.8	4	0	D	-.4	72.9	2.1	67.7	-.48	23.8
1 41 40	2.6	67.7	2.7	72.9	.02	35.1	1	0	D	-.1	72.9	2.1	67.7	-.42	22.7
1 42 15	1.4	72.9	4.3	68.5	-.67	33.3	1	0	D	-.3	72.9	1.2	67.7	-.29	22.2
1 42 16	1.9	72.9	4.6	68.5	-.62	33.8	7	0	D	-.3	72.9	1.2	67.7	-.29	23.8
1 42 17	3.9	72.9	6.8	70.0	-.98	42.9	0	0	P	-.3	72.9	1.7	67.7	-.38	24.7
1 45 17	3.7	72.9	6.7	70.0	-1.03	34.2	1	1	P	-.1	72.9	.4	70.7	-.23	10.1
1 45 55	.1	72.9	.6	67.7	-.10	19.2	0	0	D	.4	67.7	1.7	72.9	.25	28.6
1 55 7	2.7	67.7	3.5	72.9	.14	37.0	3	0	D	-.3	72.9	.9	67.7	-.23	17.4
1 55 8	4.1	67.7	7.3	71.4	.86	43.4	0	0	P	-.3	72.9	1.1	67.7	-.28	19.0
1 57 34	1.0	72.9	1.8	67.7	-.16	30.6	0	0	D	.1	72.9	2.2	67.7	-.39	30.4
2 12 12	2.0	72.9	3.2	67.7	-.23	34.2	1	0	D	-.1	72.9	.4	68.5	-.13	15.8
2 12 13	4.1	67.7	7.3	70.7	1.08	40.6	0	0	P	-.0	72.9	.6	71.4	-.40	15.8
2 18 38	.3	67.7	.4	70.0	.03	13.2	0	0	D	-.2	72.9	3.1	67.7	-.62	26.8
2 31 27	2.8	72.9	3.0	67.7	-.04	38.8	1	0	D	-.2	72.9	1.3	67.7	-.30	19.7
2 31 28	3.8	72.9	5.8	70.0	-.69	40.6	0	0	P	-.3	72.9	1.6	67.7	-.36	22.9
2 31 31	1.0	72.9	2.6	67.7	-.30	31.0	0	0	D	-.1	72.9	1.8	67.7	-.36	28.6

Table 23. Sweeps Showing Distortion Greater than 0.5 dB/MHz on the Primary Receiver

Start time - 28 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 1 24 8
Distortion Threshold : Div=99.00 dB/MHz Pri= .50 dB MHz

Sweep No.	Diversity Receiver Distortion (dB/MHz) Minimum	Maximum	Distortion	Fade (dB)	Jlevl Error Event	Reframe Event	Rcvr on Line	Primary Receiver Distortion (dB/MHz) Minimum	Maximum	Distortion	Fade (dB)
21 13 1	-.4 67.7	-.1 70.0	.05	5.5	0	0	D	-.9 72.9	1.9 67.7	-.54	18.6
0 12 9	-.1 72.9	.0 67.7	-.08	18.3	0	0	P	-1.0 72.9	1.6 67.7	-.50	20.8
0 12 11	-.1 72.9	.1 67.7	-.07	19.2	0	0	P	-1.1 72.9	1.9 67.7	-.56	21.8
0 12 12	-.1 72.9	.1 68.5	-.03	20.5	0	0	P	-1.1 72.9	2.6 67.7	-.71	24.9
0 12 13	-.1 72.9	.1 67.7	-.04	21.4	0	0	P	-.8 72.9	3.3 67.7	-.80	27.2
0 12 14	-.1 72.9	.1 67.7	-.03	21.0	0	0	P	-.8 72.9	2.9 67.7	-.72	26.8
0 12 15	-.2 72.9	.0 67.7	-.05	22.4	0	0	D	-.9 72.9	3.5 67.7	-.85	29.8
0 12 17	-.2 72.9	.0 67.7	-.05	21.4	0	0	D	-.8 72.9	2.0 67.7	-.53	29.8
0 12 49	-.1 67.7	-.1 72.9	.00	18.7	0	0	D	-1.1 72.9	1.5 67.7	-.50	20.6
0 13 43	-.1 67.7	-.1 72.9	.01	16.4	0	0	D	-1.3 72.9	1.3 67.7	-.50	18.3
0 14 24	-.2 72.9	-.1 67.7	-.02	16.0	0	0	D	-1.1 72.9	1.6 67.7	-.52	19.0
0 14 25	-.3 72.9	-.3 67.7	-.00	15.5	0	0	D	-1.1 72.9	1.6 67.7	-.52	18.8
0 14 26	-.3 72.9	-.1 67.7	-.03	15.5	0	0	D	-1.1 72.9	2.0 67.7	-.60	19.7
0 14 27	-.1 67.7	.0 72.2	.04	15.5	0	0	D	-1.3 72.9	1.9 67.7	-.61	20.2
0 14 28	-.2 72.9	.0 67.7	-.05	16.9	0	0	D	-1.2 72.9	2.3 67.7	-.68	20.6
0 14 29	-.3 72.9	0.0 67.7	-.07	17.3	0	0	D	-1.3 72.9	2.1 67.7	-.64	21.3
0 14 30	-.1 72.9	.0 67.7	-.02	18.3	0	0	D	-1.2 72.9	2.4 67.7	-.68	22.0
0 14 31	-.0 72.9	.1 67.7	-.02	20.1	0	0	D	-1.2 72.9	2.7 67.7	-.77	22.2
0 14 32	-.0 72.9	.1 67.7	-.03	20.5	0	0	D	-1.2 72.9	3.0 67.7	-.81	23.8
0 14 33	-.1 72.9	.0 67.7	-.03	20.5	0	0	D	-1.2 72.9	3.4 67.7	-.89	25.9
0 14 34	-.1 72.9	.2 67.7	-.06	21.4	0	0	D	-1.4 72.9	3.8 67.7	-1.01	29.8
0 14 35	-.2 72.9	.2 68.5	-.10	23.3	0	0	D	-1.3 72.9	5.5 68.5	-1.57	33.4
0 14 36	-.2 72.9	.3 67.7	-.11	24.6	0	0	D	1.2 72.9	5.5 70.7	-1.95	31.8
0 14 40	.0 72.9	.3 67.7	-.06	24.6	0	0	D	-.8 72.9	1.8 67.7	-.51	29.1
0 59 20	-.0 67.7	.1 72.9	.03	7.8	0	0	D	-1.0 72.9	1.7 67.7	-.51	19.5
0 59 22	-.1 72.9	.0 69.3	-.03	8.7	0	0	D	-.9 72.9	2.0 67.7	-.54	20.6
0 59 23	-.1 72.9	.1 71.4	-.08	8.7	0	0	D	-.9 72.9	2.3 67.7	-.62	19.5
1 22 31	.1 72.9	.3 67.7	-.04	7.8	0	0	D	-.6 72.9	.2 71.4	-.54	10.3
1 55 25	.6 72.9	1.3 67.7	-.13	26.5	0	0	P	-.4 72.9	2.4 67.7	-.54	26.3
1 55 27	.6 72.9	1.4 67.7	-.16	26.0	0	0	P	-.3 72.9	2.3 67.7	-.52	25.9
1 55 28	.4 72.9	1.2 68.5	-.18	26.0	0	0	P	-.4 72.9	2.2 67.7	-.52	24.9
1 57 36	1.0 72.9	1.7 67.7	-.13	31.0	0	0	D	1.8 72.9	3.6 70.7	-.79	32.0
1 57 37	1.1 72.9	1.9 67.7	-.15	31.9	0	0	D	2.1 72.9	3.6 70.7	-.66	35.0
1 57 38	1.2 72.9	1.7 67.7	-.10	32.4	0	0	D	2.5 72.9	4.9 70.7	-1.08	35.9
1 57 39	.9 72.9	1.8 67.7	-.17	33.3	0	0	D	2.8 72.9	6.0 70.7	-1.43	38.0
1 57 40	1.1 72.9	1.9 67.7	-.15	34.7	0	0	D	4.3 67.7	8.2 71.4	1.06	38.0
1 57 41	1.0 72.9	1.8 67.7	-.14	32.9	0	0	D	1.8 67.7	4.3 70.7	.81	42.3
1 57 42	1.2 72.9	1.8 67.7	-.12	32.4	0	0	D	.6 67.7	2.4 70.7	.59	33.2
2 18 32	.1 72.9	.6 68.5	-.11	10.1	0	0	P	-.6 72.9	2.2 67.7	-.54	21.3
2 18 33	.2 72.9	.3 68.5	-.03	11.4	0	0	P	-.4 72.9	2.8 67.7	-.62	22.9
2 18 34	.2 67.7	.3 69.3	.09	11.9	0	0	P	-.4 72.9	2.7 67.7	-.58	24.0
2 18 35	.3 72.9	.4 67.7	-.02	11.9	0	0	P	-.4 72.9	2.6 67.7	-.57	24.5
2 18 36	.3 67.7	.4 72.9	.01	11.9	0	0	P	-.3 72.9	2.7 67.7	-.58	23.3
2 18 37	.4 72.9	.5 68.5	-.01	11.4	0	0	P	-.3 72.9	2.8 67.7	-.59	24.3
2 18 38	.3 67.7	.4 70.0	.03	13.2	0	0	D	-.2 72.9	3.1 67.7	-.62	26.8
2 28 5	.8 72.9	1.5 67.7	-.15	25.1	0	0	D	3.5 72.9	9.0 70.7	-2.47	19.9
2 28 27	.5 72.9	1.0 67.7	-.10	26.0	0	0	D	1.5 67.7	6.2 72.2	1.05	31.4
2 28 28	.6 72.9	.8 68.5	-.03	24.6	0	0	D	1.3 67.7	5.0 71.4	1.00	37.1
2 28 29	.6 72.9	.7 67.7	-.01	24.2	0	0	D	.2 67.7	2.7 70.7	.83	33.4
2 31 34	.4 72.9	1.6 67.7	-.23	29.2	0	0	D	1.3 67.7	3.6 71.4	.62	33.2
2 31 35	.6 72.9	1.4 68.5	-.18	26.9	0	0	D	1.1 72.9	2.6 70.7	-.70	31.6
2 31 36	.4 72.9	1.2 67.7	-.16	26.5	0	0	D	1.3 72.9	3.8 70.7	-1.10	33.4
2 31 37	.5 72.9	1.0 67.7	-.08	26.0	0	0	D	.9 72.9	4.4 70.0	-1.20	32.0
2 31 38	.4 72.9	.8 67.7	-.08	23.7	0	0	D	.9 72.9	3.1 70.7	-1.00	30.4

Table 24. Sweeps Showing Distortion Greater than 0.5 dB/MHz on the Diversity Receiver

Start time - 28 May 1980 2300hr   Standard Spectral Density Sweep No. 1 24 8
Path - Mt. Venda to Mt. Corna   Distortion Threshold : Div= .50 dB/MHz Pri=99.00 dB MHz

Sweep No.	D i v e r s i t y Receiver Distortion (dB/MHz) Minumum		Maximum		Distortion	Fade(dB)	3levl Error Event	Ref-rame Event	Rcvr on Line	P r i m a r y Receiver Distortion (dB/MHz) Minimum		Maximum		Distortion	Fade(dB)
23 27 47	4.1	67.7	6.4	71.4	.61	37.0	0	0	P	-.8	72.9	-.2	67.7	-.12	8.9
23 27 48	4.2	67.7	7.2	71.4	.81	39.2	0	0	P	-.8	72.9	-.2	67.7	-.11	9.4
23 27 49	4.2	67.7	6.8	70.0	1.13	39.7	0	0	P	-.6	72.9	-.2	69.3	-.11	9.6
23 43 41	2.8	72.9	5.2	69.3	-.65	26.5	0	0	P	-.7	72.9	-.3	70.7	-.19	3.2
23 59 19	4.2	67.7	6.9	70.7	.91	40.6	0	0	P	-.8	72.9	.1	67.7	-.17	16.5
23 59 20	4.2	67.7	6.8	70.7	.85	36.5	0	0	P	-.8	72.9	-.1	67.7	-.13	16.5
1 42 11	1.2	72.9	3.9	68.5	-.60	31.9	0	0	D	-.3	72.9	1.3	67.7	-.29	20.4
1 42 12	1.4	72.9	4.0	69.5	-.57	33.3	0	0	D	-.3	72.9	1.2	67.7	-.30	20.6
1 42 15	1.4	72.9	4.3	68.5	-.67	33.3	1	0	D	-.3	72.9	1.2	67.7	-.29	22.2
1 42 16	1.9	72.9	4.6	68.5	-.62	33.8	7	0	D	-.3	72.9	1.2	67.7	-.29	23.8
1 42 17	3.9	72.9	6.8	70.0	-.98	42.9	0	0	P	-.3	72.9	1.7	67.7	-.38	24.7
1 42 18	4.1	67.7	7.1	70.7	.99	43.8	0	0	P	-.4	72.9	1.6	67.7	-.37	24.9
1 42 19	4.1	67.7	5.6	70.0	.63	39.7	0	0	P	-.2	72.9	1.5	67.7	-.32	24.9
1 42 20	4.1	67.7	5.4	69.3	.81	39.2	0	0	P	-.3	72.9	1.7	67.7	-.39	25.4
1 45 16	1.8	72.9	4.7	68.5	-.64	30.1	0	0	P	-.1	72.9	.3	67.7	-.07	9.2
1 45 17	3.7	72.9	6.7	70.0	-1.03	34.2	1	1	P	-.1	72.9	.4	70.7	-.23	10.1
1 45 18	4.0	72.9	6.6	70.0	-.88	37.4	0	0	P	-.2	72.9	.3	70.7	-.23	9.6
1 55 8	4.1	67.7	7.3	71.4	.86	43.4	0	0	P	-.3	72.9	1.1	67.7	-.28	19.0
1 55 9	4.1	67.7	7.5	70.7	1.12	50.2	0	0	P	-.5	72.9	.9	67.7	-.27	19.2
1 55 10	4.3	67.7	7.3	70.7	1.01	42.9	0	0	P	-.3	72.9	1.0	67.7	-.25	18.6
1 55 11	4.1	67.7	5.5	70.0	.63	38.3	0	0	P	-.4	72.9	1.0	67.7	-.27	18.3
2 12 13	4.1	67.7	7.3	70.7	1.08	40.6	0	0	P	-.0	72.9	.6	71.4	-.40	15.8
2 12 14	4.3	67.7	6.7	70.0	1.07	40.1	0	0	P	.2	72.9	.5	67.7	-.06	16.0
2 12 15	4.2	67.7	6.4	70.0	.94	37.4	0	0	P	-.0	72.9	.6	67.7	-.12	15.8
2 12 16	4.2	67.7	7.5	70.7	1.10	41.1	0	0	P	-.1	72.9	.5	67.7	-.13	16.3
2 12 17	4.1	67.7	7.3	70.7	1.07	42.4	0	0	P	-.1	72.9	.4	68.5	-.11	16.3
2 12 18	4.1	67.7	7.4	70.7	1.10	42.0	0	0	P	-.1	72.9	.4	67.7	-.10	16.3
2 12 19	4.3	67.7	6.9	71.4	.72	41.1	0	0	P	.2	72.9	.3	70.7	-.08	16.3
2 12 20	4.2	67.7	6.6	70.0	1.05	40.6	0	0	P	0.0	72.9	.5	67.7	-.10	16.0
2 12 21	4.2	67.7	7.3	70.7	1.06	40.6	0	0	P	0.0	72.9	.5	68.5	-.10	15.8
2 12 22	4.3	67.7	7.5	70.7	1.06	48.4	0	0	P	-.0	72.9	.5	67.7	-.11	16.3
2 12 23	4.1	67.7	7.4	71.4	.90	41.5	0	0	P	-.1	72.9	.5	67.7	-.12	15.8
2 12 24	4.2	67.7	7.4	70.7	1.05	43.4	0	0	P	-.0	72.9	.6	67.7	-.12	15.3
2 12 25	4.1	67.7	6.9	70.7	.95	41.5	0	0	P	-.1	72.9	.5	67.7	-.12	15.8
2 12 26	4.1	67.7	7.1	71.4	.80	40.6	0	0	P	.0	72.9	.4	68.5	-.03	15.8
2 31 28	3.8	72.9	5.8	70.0	-.69	40.6	0	0	P	-.3	72.9	1.6	67.7	-.36	22.9

Table 25. Sweeps Showing Flat Fading Greater than 35 dB

Start time - 28 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 1 24 8
Distortion Threshold : Div= 0.00 dB/MHz Pri= 0.00 dB MHz

	Diversity Receiver: Distortion (dB/MHz) Minimum	Maximum	Distortion	Fade(dB)	3levl Error Event	Ref-rame Event	Rcvr on Line	Primary Receiver: Distortion (dB/MHz) Minimum	Maximum	Distortion	Fade(dB)
Sweep No.											
23 27 47	4.1 67.7	6.4 71.4	.61	37.0	0	0	P	-.8 72.9	-.2 67.7	-.12	8.9
23 27 48	4.2 67.7	7.2 71.4	.81	39.2	0	0	P	-.8 72.9	-.2 67.7	-.11	9.4
23 27 49	4.2 67.7	6.8 70.0	1.13	39.7	0	0	P	-.6 72.9	-.2 69.3	-.11	9.6
23 59 19	4.2 67.7	6.9 70.7	.91	40.6	0	0	P	-.8 72.9	.1 67.7	-.17	16.5
23 59 20	4.2 67.7	6.8 70.7	.85	36.5	0	0	P	-.8 72.9	-.1 67.7	-.13	16.5
1 41 24	2.2 67.7	3.2 72.9	.18	36.1	0	0	D	-.5 72.9	1.1 67.7	-.31	21.5
1 41 25	2.2 67.7	2.8 72.9	.12	35.1	0	0	D	-.2 72.9	1.0 67.7	-.23	21.8
1 41 26	2.4 67.7	2.7 72.9	.06	36.1	0	0	D	-.2 72.9	1.1 67.7	-.25	22.7
1 41 39	2.3 67.7	3.5 72.9	.23	35.1	0	0	D	-.2 72.9	2.2 67.7	-.46	22.4
1 41 40	2.6 67.7	2.7 72.9	.02	35.1	1	0	D	-.1 72.9	2.1 67.7	-.42	22.7
1 41 42	1.7 72.9	2.0 67.7	-.07	36.1	0	0	D	-.5 72.9	1.4 67.7	-.38	22.0
1 42 17	3.9 72.9	6.8 70.0	-.98	42.9	0	0	P	-.3 72.9	1.7 67.7	-.38	24.7
1 42 18	4.1 67.7	7.1 70.7	.99	43.8	0	0	P	-.4 72.9	1.6 67.7	-.37	24.9
1 42 19	4.1 67.7	5.6 70.0	.63	39.7	0	0	P	-.2 72.9	1.5 67.7	-.32	24.9
1 42 20	4.1 67.7	5.4 69.3	.81	39.2	0	0	P	-.3 72.9	1.7 67.7	-.39	25.4
1 42 21	2.6 72.9	3.0 67.7	-.08	35.1	0	0	P	-.3 72.9	1.5 67.7	-.35	24.0
1 45 18	4.0 72.9	6.6 70.0	-.88	37.4	0	0	P	-.2 72.9	.3 70.7	-.23	9.6
1 45 19	1.9 72.9	3.1 67.7	-.23	36.1	0	0	P	-.4 72.9	.2 69.3	-.17	8.9
1 55 7	2.7 67.7	3.5 72.9	.14	37.0	3	0	D	-.3 72.9	.9 67.7	-.23	17.4
1 55 8	4.1 67.7	7.3 71.4	.86	43.4	0	0	P	-.3 72.9	1.1 67.7	-.28	19.0
1 55 9	4.1 67.7	7.5 70.7	1.12	50.2	0	0	P	-.5 72.9	.9 67.7	-.27	19.2
1 55 10	4.3 67.7	7.3 70.7	1.01	42.9	0	0	P	-.3 72.9	1.0 67.7	-.25	18.6
1 55 11	4.1 67.7	5.5 70.0	.63	38.3	0	0	P	-.4 72.9	1.0 67.7	-.27	18.3
1 55 12	3.7 72.9	5.3 69.3	-.44	36.5	0	0	P	-.3 72.9	.9 67.7	-.23	18.1
1 57 37	1.1 72.9	1.9 67.7	-.15	31.9	0	0	D	2.1 72.9	3.6 70.7	-.66	35.0
1 57 38	1.2 72.9	1.7 67.7	-.10	32.4	0	0	D	2.5 72.9	4.9 70.7	-1.08	35.9
1 57 39	.9 72.9	1.8 67.7	-.17	33.3	0	0	D	2.8 72.9	6.0 70.7	-1.43	38.0
1 57 40	1.1 72.9	1.9 67.7	-.15	34.7	0	0	D	4.3 67.7	8.2 71.4	1.06	38.0
1 57 41	1.0 72.9	1.8 67.7	-.14	32.9	0	0	D	1.8 67.7	4.3 70.7	.81	42.3
1 57 46	1.9 72.9	2.7 67.7	-.14	35.6	0	0	D	.6 72.9	1.0 67.7	-.08	31.1
2 12 13	4.1 67.7	7.3 70.7	1.08	40.6	0	0	P	-.0 72.9	.6 71.4	-.40	15.8
2 12 14	4.3 67.7	6.7 70.0	1.07	40.1	0	0	P	.2 72.9	.5 67.7	-.06	16.0
2 12 15	4.2 67.7	6.4 70.0	.94	37.4	0	0	P	-.0 72.9	.6 67.7	-.12	15.8
2 12 16	4.2 67.7	7.5 70.7	1.10	41.1	0	0	P	-.1 72.9	.5 67.7	-.13	16.3
2 12 17	4.1 67.7	7.3 70.7	1.07	42.4	0	0	P	-.1 72.9	.4 68.5	-.11	16.3
2 12 18	4.1 67.7	7.4 70.7	1.10	42.0	0	0	P	-.1 72.9	.4 67.7	-.10	16.3
2 12 19	4.3 67.7	6.9 71.4	.92	41.1	0	0	P	.2 72.9	.3 70.7	-.08	16.3
2 12 20	4.2 67.7	6.6 70.0	1.05	40.6	0	0	P	0.0 72.9	.5 67.7	-.10	16.0
2 12 21	4.2 67.7	7.3 70.7	1.06	40.6	0	0	P	0.0 72.9	.5 68.5	-.10	15.8
2 12 22	4.3 67.7	7.5 70.7	1.06	48.4	0	0	P	-.0 72.9	.5 67.7	-.11	16.3
2 12 23	4.1 67.7	7.4 71.4	.90	41.5	0	0	P	-.1 72.9	.5 67.7	-.12	15.8
2 12 24	4.2 67.7	7.4 70.7	1.05	43.4	0	0	P	-.0 72.9	.6 67.7	-.12	15.3
2 12 25	4.1 67.7	6.9 70.7	.95	41.5	0	0	P	-.1 72.9	.5 67.7	-.12	15.8
2 12 26	4.1 67.7	7.1 71.4	.80	40.6	0	0	P	.0 72.9	.4 68.5	-.08	15.8
2 12 27	3.9 72.9	5.7 69.3	-.50	40.6	0	0	P	-.1 72.9	.5 67.7	-.11	15.8
2 28 28	.6 72.9	.8 68.5	-.03	24.6	0	0	D	1.3 67.7	5.0 71.4	1.00	37.1
2 31 27	2.8 72.9	3.0 67.7	-.04	38.8	1	0	D	-.2 72.9	1.3 67.7	-.30	19.7
2 31 28	3.8 72.9	5.8 70.0	-.69	40.6	0	0	P	-.3 72.9	1.6 67.7	-.36	22.9

Table 26. Cumulative Distortion Distribution (Slopes only) for
12-13 May 1980, 2300-0400, Mt. Venda to Mt. Corna,
Standard Spectrum Sweep 1 0 15

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	5	150	155	.0078	5	5234	.2643
	.4	1	26	27	.0014	10	1058	.0534
	.6		10	10	.0005	15	142	.0072
	.8		1	1	.0001	20	10	.0005
	1.0		1	1	.0001	25	1	.0001
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	3.0			0	0.0000	50		0.0000
Primary								
	.2	7	828	835	.0422	5	6029	.3045
	.4	3	110	113	.0057	10	2649	.1338
	.6	3	20	23	.0012	15	863	.0436
	.8	1	1	2	.0001	20	129	.0065
	1.0		1	1	.0001	25	20	.0010
	1.2			0	0.0000	30	7	.0004
	1.4			0	0.0000	35	1	.0001
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2	2	543	545	.0275	5	3571	.1804
	.4		78	78	.0039	10	1822	.0920
	.6		7	7	.0004	15	613	.0310
	.8			0	0.0000	20	77	.0039
	1.0			0	0.0000	25	2	.0001
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 27. Cumulative Distortion Distribution (Slopes only) for
12 May 1980, 2300-2400, Mt. Venda to Mt. Corna,
Standard Spectrum Sweep 1 0 15

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	2	30	32	.0097	5	247	.0748
	.4	1	3	4	.0012	10	22	.0067
	.6		2	2	.0006	15	7	.0021
	.8			0	0.0000	20	1	.0003
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2		121	121	.0367	5	674	.2042
	.4		6	6	.0018	10	177	.0536
	.6			0	0.0000	15	15	.0045
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		53	53	.0161	5	392	.1188
	.4			0	0.0000	10	115	.0348
	.6			0	0.0000	15	4	.0012
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 28. Cumulative Distortion Distribution (Slopes only) for 13 May 1980, 0000-0100, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 0 15

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2		24	24	.0073	5	209	.0633
	.4			0	0.0000	10	15	.0045
	.6			0	0.0000	15		0.0000
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2		39	39	.0118	5	282	.0855
	.4		4	4	.0012	10	82	.0248
	.6		2	2	.0006	15	8	.0024
	.8		1	1	.0003	20	3	.0009
	1.0		1	1	.0003	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2			0	0.0000	5		0.0000
	.4			0	0.0000	10		0.0000
	.6			0	0.0000	15		0.0000
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 29. Cumulative Distortion Distribution (Slopes only) for 13 May 1980, 0100-0200, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 0 15

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	3	65	68	.0206	5	1509	.4573
	.4		18	18	.0055	10	625	.1094
	.6		6	6	.0018	15	108	.0327
	.8			0	0.0000	20	8	.0024
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	2	176	178	.0539	5	1693	.5130
	.4		6	6	.0018	10	1026	.3109
	.6			0	0.0000	15	459	.1391
	.8			0	0.0000	20	67	.0203
	1.0			0	0.0000	25	8	.0024
	1.2			0	0.0000	30	3	.0009
	1.4			0	0.0000	35	1	.0003
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		79	79	.0239	5	963	.2918
	.4		3	3	.0009	10	693	.2100
	.6			0	0.0000	15	278	.0842
	.8			0	0.0000	20	38	.0115
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 30. Cumalative Distortion Distribution (Slopes only) for 13 May 1980, 0200-0300, Mt. Venda to Mt. Corna, Standard Spectrum Sweep No. 1 0 15

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2		28	28	.0085	5	1282	.3885
	.4		5	5	.0015	10	338	.1024
	.6		2	2	.0006	15	27	.0082
	.8		1	1	.0003	20	1	.0003
	1.0		1	1	.0003	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2		95	95	.0288	5	1242	.3764
	.4			0	0.0000	10	586	.1776
	.6			0	0.0000	15	172	.0521
	.8			0	0.0000	20	5	.0015
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2		95	95	.0288	5	1242	.3764
	.4			0	0.0000	10	586	.1776
	.6			0	0.0000	15	172	.0521
	.8			0	0.0000	20	5	.0015
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 31. Cumulative Distortion Distribution (Slopes only) for 13 May 1980, 0300-0400, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 1 0 15

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2		3	3	.0009	5	1987	.6021
	.4			0	0.0000	10	58	.0176
	.6			0	0.0000	15		0.0000
	.8			0	0.0000	20		0.0000
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	5	397	402	.1218	5	2138	.6479
	.4	3	94	97	.0294	10	778	.2358
	.6	3	18	21	.0064	15	209	.0633
	.8	1		1	.0003	20	54	.0164
	1.0			0	0.0000	25	12	.0036
	1.2			0	0.0000	30	4	.0012
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Recv.-On line								
	.2	2	316	318	.0964	5	974	.2952
	.4		75	75	.0227	10	428	.1297
	.6		7	7	.0021	15	159	.0482
	.8			0	0.0000	20	34	.0103
	1.0			0	0.0000	25	1	.0003
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 32. Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 0 1 15, Mt. Venda to Mt. Corna, 12-13 May 1980 (Slopes only)

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	.2	0	287	1.0000	0	287	1.0000
		1	93	.3240	1	215	.7491
		2	49	.1707	2	170	.5923
		4	30	.1045	4	117	.4077
		8	16	.0557	8	91	.3171
		16	7	.0244	16	64	.2230
		32	3	.0105	32	55	.1916
		64	2	.0070	64	42	.1463
		128			128	31	.1080
		256			256	20	.0697
		512			512	9	.0314
		1024			1024	2	.0070
		2048			2048		
2300-400							
	.4	0	29	1.0000	0	29	1.0000
		1	13	.4483	1	25	.8621
		2	7	.2414	2	16	.5517
		4	3	.1034	4	14	.4828
		8	3	.1034	8	12	.4138
		16	3	.1034	16	11	.3793
		32			32	9	.3103
		64			64	9	.3103
		128			128	8	.2759
		256			256	6	.2069
		512			512	4	.1379
		1024			1024	4	.1379
		2048			2048	3	.1034

Table 32. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver using Standard Sweep 0 1 15, Mt. Venda to Mt. Corna, 12-13 May 1980 (Slopes only)

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	.6	0	9	1.0000	0	9	1.0000
		1	8	.8889	1	5	.5556
		2	4	.4444	2	5	.5556
		4	1	.1111	4	3	.3333
		8			8	3	.3333
		16			16	3	.3333
		32			32	2	.2222
		64			64	2	.2222
		128			128	2	.2222
		256			256	2	.2222
		512			512	2	.2222
		1024			1024	2	.2222
		2048			2048	2	.2222
2300-400							
	.8	0	2	1.0000	0	2	1.0000
		1			1	2	1.0000
		2			2	2	1.0000
		4			4	2	1.0000
		8			8	2	1.0000
		16			16	2	1.0000
		32			32	2	1.0000
		64			64	2	1.0000
		128			128	2	1.0000
		256			256	2	1.0000
		512			512	2	1.0000
		1024			1024	2	1.0000
		2048			2048	2	1.0000

Table 33. Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 0 15, Mt. Venda to Mt. Corna, 12-13 May 1980 (Slopes only)

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400							
	.2	0	48	1.0000	0	48	1.0000
		1	25	.5208	1	44	.9167
		2	17	.3542	2	39	.8125
		4	9	.1875	4	31	.6458
		8	4	.0833	8	30	.6250
		16			16	29	.6042
		32			32	29	.6042
		64			64	28	.5833
		128			128	23	.4792
		256			256	16	.3333
		512			512	9	.1875
		1024			1024	5	.1042
		2048			2048	1	.0208
2300-400							
	.4	0	11	1.0000	0	11	1.0000
		1	5	.4545	1	9	.8182
		2	3	.2727	2	9	.8182
		4	2	.1818	4	9	.8182
		8	1	.0909	8	9	.8182
		16			16	9	.8182
		32			32	9	.8182
		64			64	9	.8182
		128			128	9	.8182
		256			256	6	.5455
		512			512	4	.3636
		1024			1024	3	.2727
		2048			2048	3	.2727

Table 33. (Cont.) Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver using Standard Sweep 1 0 15, Mt. Venda to Mt. Corna, 12-13 May 1980 (Slopes only)

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2300-400	.6	0	6	1.0000	0	6	1.0000
		1	3	.5000	1	6	1.0000
		2	1	.1667	2	6	1.0000
		4			4	6	1.0000
		8			8	6	1.0000
		16			16	6	1.0000
		32			32	6	1.0000
		64			64	6	1.0000
		128			128	6	1.0000
		256			256	5	.8333
		512			512	4	.6667
		1024			1024	3	.5000
		2048			2048	3	.5000
2300-400	.8	0	1	1.0000	0	1	1.0000
		1			1	1	1.0000
		2			2	1	1.0000
		4			4	1	1.0000
		8			8	1	1.0000
		16			16	1	1.0000
		32			32	1	1.0000
		64			64	1	1.0000
		128			128	1	1.0000
		256			256	1	1.0000
		512			512	1	1.0000
		1024			1024	1	1.0000
		2048			2048	1	1.0000

Table 34. Event Occurrences during the 12-13 May 2300-0400 Data Period

Start time - 12 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 1 0 15
Distortion Threshold : Div= 0.00 dB/MHz Pri= 0.00 dB MHz

Sweep No.	Diversity Receiver Distortion (dB/MHz) Minumum		Maximum		Distortion	Fade(dB)	3levl Error Event	Ref-rame Event	Rcvr on Line	Primary Receiver Distortion (dB/MHz) Minimum		Maximum		Distortion	Fade(dB)
23 9 44	3.1	72.9	3.3	67.7	-.04	15.0	3	0	D	.2	72.9	.3	67.7	-.03	5.6
23 9 19	4.4	67.7	5.6	72.9	.24	8.5	1	1	P	.2	72.9	.3	67.7	-.02	5.8
23 35 11	4.6	67.7	7.0	70.0	1.05	9.8	0	1	P	.1	72.9	.2	67.7	-.02	.0
23 43 4	.1	67.7	.1	72.9	.01	-5.1	0	0	D	-.0	72.9	.5	67.7	-.10	15.3
1 26 30	3.6	67.7	4.2	72.9	.11	14.2	5	0	P	0.0	72.9	.2	68.5	-.05	6.6
1 29 33	-.1	72.9	.2	67.7	-.06	9.7	0	0	D	.4	72.9	1.3	67.7	-.17	27.3
1 30 53	2.2	72.9	5.1	68.5	-.65	20.3	3	0	D	-.4	72.9	.5	68.5	-.21	15.2
1 36 7	2.8	67.7	4.7	72.9	.38	17.5	15	0	D	-.0	72.9	.3	67.7	-.06	12.4
1 36 8	5.2	67.7	8.4	70.7	1.08	22.1	0	0	P	.2	72.9	.3	68.5	-.03	14.7
1 48 55	5.2	67.7	7.7	71.4	.70	18.6	1	1	P	-.1	72.9	.3	67.7	-.09	7.1
2 40 23	4.1	67.7	8.2	70.7	1.35	22.0	1	1	P	-.2	72.9	.1	69.3	-.10	9.9
3 26 12	-.0	67.7	.3	71.4	.08	12.3	0	0	D	-.9	67.7	3.0	72.9	.74	31.0

Table 35. Sweep Showing Distortion Greater than 0.5 dB/MHz on the Primary Receiver

Start time - 13 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 1 0 15
Distortion Threshold : Div=99.00 dB/MHz Pri= .50 dB MHz

	Diversity Receiver							3levl	Ref-	Rcvr	Primary Receiver					
	Distortion (dB/MHz)							Error	rame	on	Distortion (dB/MHz)					
Sweep No.	Minumum		Maximum		Distortion	Fade(dB)		Event	Event	Line	Minimum		Maximum		Distortion	Fade(dB)
0 12 27	-.0	67.7	.0	72.9	.01	1.5		0	0	D	-.5	72.9	2.7	67.7	-.62	21.5
0 12 28	-.2	67.7	.1	71.4	.07	1.1		0	0	D	-.5	72.9	4.0	67.7	-.88	21.1
1 29 36	.2	72.9	.3	71.4	-.11	14.1		0	0	D	1.8	67.7	4.1	71.4	.64	30.8
3 25 25	.1	67.7	.3	69.3	.12	9.7		0	0	P	-.8	72.9	2.1	67.7	-.55	20.4
3 25 27	-.1	72.9	.3	71.4	-.27	11.0		0	0	P	-.8	72.9	2.0	67.7	-.53	20.6
3 25 28	.1	67.7	.3	69.3	.10	10.9		0	0	P	-.8	72.9	1.9	67.7	-.51	21.1
3 25 32	.1	72.9	.3	69.3	-.04	10.9		0	0	P	-.7	72.9	2.3	67.7	-.57	21.6
3 25 33	-.1	67.7	.3	70.7	.12	11.1		0	0	P	-.7	72.9	2.3	67.7	-.58	22.8
3 25 35	-.2	72.9	.4	71.4	-.37	10.1		0	0	P	-.6	72.9	2.2	67.7	-.53	21.5
3 26 12	-.0	67.7	.3	71.4	.08	12.3		0	0	D	-.9	67.7	3.0	72.9	.74	31.0
3 26 13	-.0	72.9	.2	69.3	-.08	13.0		0	0	D	-1.0	67.7	5.1	71.4	1.65	32.7
3 26 14	-.2	67.7	.3	71.4	.14	12.5		0	0	D	.2	67.7	7.8	71.4	2.06	33.5
3 26 15	.1	67.7	.2	69.3	.09	12.5		0	0	D	-.3	67.7	1.6	71.4	.52	30.5
3 26 19	-.1	67.7	.1	70.0	.10	10.7		0	0	D	-.7	72.9	2.4	67.7	-.59	25.7
3 26 20	.1	72.9	.3	71.4	-.15	10.9		0	0	D	-.6	72.9	2.6	67.7	-.62	26.3
3 26 21	0.0	72.9	.3	71.4	-.21	10.9		0	0	D	-.5	72.9	2.3	67.7	-.54	25.5
3 26 23	.0	67.7	.2	72.9	.03	10.6		0	0	D	-.7	72.9	2.6	67.7	-.64	25.0
3 26 24	-.1	67.7	.3	71.4	.09	10.1		0	0	D	-.6	72.9	2.3	67.7	-.54	23.5
3 26 25	-.3	67.7	.2	72.9	.10	9.7		0	0	D	-.7	72.9	2.6	67.7	-.63	22.7
3 26 26	-.2	67.7	.3	72.9	.08	8.4		0	0	D	-.6	72.9	2.2	67.7	-.54	20.7
3 26 27	-.1	67.7	.3	71.4	.09	9.2		0	0	D	-.7	72.9	2.0	67.7	-.53	21.0
3 26 29	.1	67.7	.2	72.9	.02	9.0		0	0	D	-.6	72.9	2.4	67.7	-.57	20.6
3 26 30	-.1	67.7	.2	71.4	.09	9.0		0	0	D	-.8	72.9	2.5	67.7	-.64	21.2
3 26 31	-.0	67.7	.3	69.3	.24	8.7		0	0	D	-.6	72.9	2.3	67.7	-.55	20.2

Table 36. Sweeps Showing Distortion Greater than 0.5 dB/MHz on the Diversity Receiver

Start time - 12 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 1 0 15
Distortion Threshold : Div= .50 dB/MHz Pri=999.0 dB MHz

	D i v e r s i t y	Receiver								P r i m a r y	Receiver				
	D i s t o r t i o n (dB/MHz)									D i s t o r t i o n (dB/MHz)					
Sweep No.	Minumum		Maximum		Distortion	Fade(dB)	3levl Error Event	Ref-rame Event	Rcvr on Line	Minimum		Maximum		Distortion	Fade(dB)
23 3 5	-2.3	67.7	.4	69.3	1.67	.3	0	0	D	-.1	72.9	.6	67.7	-.14	1.7
23 9 20	2.3	72.9	5.2	68.5	-.66	8.9	0	0	P	.2	72.9	.5	68.5	-.07	4.7
23 35 11	4.6	67.7	7.0	70.0	1.05	9.8	0	1	P	.1	72.9	.2	67.7	-.02	.0
23 35 12	5.2	67.7	7.9	70.7	.91	15.0	0	0	P	.1	72.9	.2	71.4	-.08	2.7
23 35 13	5.2	67.7	8.5	71.4	.88	14.6	0	0	P	-.1	72.9	.3	71.4	-.23	.9
23 35 14	5.3	67.7	8.5	71.4	.86	19.0	0	0	P	0.0	72.9	.3	67.7	-.05	1.1
23 35 15	5.3	67.7	8.5	70.7	1.05	15.8	0	0	P	.1	67.7	.2	72.9	.03	6.2
23 35 16	5.2	67.7	8.6	71.4	.91	19.8	0	0	P	.1	67.7	.1	71.4	.01	2.7
23 35 17	5.2	67.7	7.8	70.0	1.14	18.9	0	0	P	-.1	72.9	.4	68.5	-.10	2.0
23 51 45	1.1	72.9	3.8	67.7	-.51	6.5	0	0	D	-.0	67.7	.2	72.9	.04	-6.2
1 26 31	2.0	72.9	6.6	69.3	-1.26	17.3	0	0	P	.1	72.9	.2	67.7	-.03	6.5
1 30 53	2.2	72.9	5.1	68.5	-.65	20.3	3	0	D	-.4	72.9	.5	68.5	-.21	15.2
1 30 54	1.6	72.9	4.8	67.7	-.62	20.7	0	0	D	-.1	72.9	.6	67.7	-.12	14.7
1 30 55	1.6	72.9	4.5	67.7	-.56	18.2	0	0	D	-.1	72.9	.4	67.7	-.10	14.3
1 36 8	5.2	67.7	8.4	70.7	1.08	22.1	0	0	P	.2	72.9	.3	68.5	-.03	14.7
1 36 9	5.0	72.9	8.3	70.7	-1.48	26.3	0	0	P	.1	67.7	.2	72.9	.00	14.5
1 36 10	1.3	72.9	4.5	67.7	-.61	20.3	0	0	P	.2	72.9	.4	68.5	-.04	12.7
1 36 11	.9	72.9	3.5	67.7	-.51	17.7	0	0	P	-.3	72.9	.3	68.5	-.13	12.9
1 48 55	5.2	67.7	7.7	71.4	.70	18.6	1	1	P	-.1	72.9	.3	67.7	-.09	7.1
1 49 1	5.2	67.7	8.2	71.4	.80	20.3	0	0	P	.1	72.9	.2	67.7	-.02	7.1
1 49 2	5.1	67.7	7.5	70.0	1.04	21.7	0	0	P	.2	72.9	.3	71.4	-.06	3.6
2 40 23	4.1	67.7	8.2	70.7	1.35	22.0	1	1	P	-.2	72.9	.1	69.3	-.10	9.9
2 40 24	.7	72.9	5.9	68.5	-1.17	17.4	0	0	P	0.0	72.9	.2	68.5	-.04	7.8
2 40 25	.5	72.9	3.6	67.7	-.60	14.9	0	0	P	.2	72.9	.3	68.5	-.03	7.0

Table 37. Sweeps Showing Flat Fading Greater than 25 dB

Start time - 13 May 1980 2300hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 1 0 15
Distortion Threshold : Div= 0.00 dB/MHz Pri= 0.00 dB MHz

Sweep No.			Diversity Receiver Distortion (dB/MHz) Minumum		Maximum		Distortion	Fade(dB)	3levl Error Event	Ref-rame Event	Rcvr on Line	Primary Receiver Distortion (dB/MHz) Minimum		Maximum		Distortion	Fade(dB)
1	29	33	-.1	72.9	.2	67.7	-.06	9.7	0	0	D	.4	72.9	1.3	67.7	-.17	27.3
1	29	34	-.2	72.9	.2	69.3	-.12	11.6	0	0	D	.6	72.9	1.3	67.7	-.12	32.1
1	29	35	.3	72.9	.3	67.7	-.01	13.0	0	0	D	.7	67.7	2.0	72.9	.24	36.8
1	29	36	.2	72.9	.3	71.4	-.11	14.1	0	0	D	1.8	67.7	4.1	71.4	.64	30.8
1	29	37	.1	67.7	.3	71.4	.06	12.3	0	0	D	.7	72.9	1.1	67.7	-.08	25.9
1	34	46	.1	72.9	.6	67.7	-.10	14.6	0	0	D	.1	72.9	1.2	67.7	-.21	25.1
1	34	47	.0	72.9	.5	68.5	-.10	14.9	0	0	D	.3	72.9	1.1	67.7	-.16	25.3
1	36	9	5.0	72.9	8.3	70.7	-1.48	26.3	0	0	P	.1	67.7	.2	72.9	.00	14.5
1	41	17	.2	72.9	.5	67.7	-.06	10.9	0	0	P	.1	72.9	1.3	67.7	-.24	26.1
3	26	11	-.1	72.9	.2	71.4	-.17	11.4	0	0	P	-.2	67.7	1.4	72.9	.30	26.9
3	26	12	-.0	67.7	.3	71.4	.08	12.3	0	0	D	-.9	67.7	3.0	72.9	.74	31.0
3	25	13	-.0	72.9	.2	69.3	-.08	13.0	0	0	D	-1.0	67.7	5.1	71.4	1.65	32.7
3	26	14	-.2	67.7	.3	71.4	.14	12.5	0	0	D	.2	67.7	7.8	71.4	2.06	33.5
3	26	15	.1	67.7	.2	69.3	.09	12.5	0	0	D	-.3	67.7	1.6	71.4	.52	30.5
3	26	16	-.3	72.9	.2	69.3	-.14	11.4	0	0	D	-.0	72.9	1.2	67.7	-.24	28.2
3	26	17	-.2	67.7	.2	69.3	.24	11.3	0	0	D	-.3	72.9	2.0	67.7	-.44	27.9
3	26	18	-.1	67.7	.2	71.4	.09	10.7	0	0	D	-.2	72.9	2.1	67.7	-.45	26.7
3	26	19	-.1	67.7	.1	70.0	.10	10.7	0	0	D	-.7	72.9	2.4	67.7	-.59	25.7
3	26	20	.1	72.9	.3	71.4	-.15	10.9	0	0	D	-.6	72.9	2.6	67.7	-.62	26.3
3	26	21	0.0	72.9	.3	71.4	-.21	10.9	0	0	D	-.5	72.9	2.3	67.7	-.54	25.5
3	26	22	-.2	67.7	.2	69.3	.24	10.8	0	0	D	-.3	72.9	2.0	67.7	-.45	26.5

Table 38. Cumulative Distortion Distribution for 13-14 May 1980, 2200-0300, Mt. Venda to Mt. Corna, Standard Spectrum Sweep 0 0 54 (Distortion Values Include Nulls)

Receiver	Absolute Distortion in dB/MHz	No. of Samples >= the + Distortion	No. of Samples <= the - Distortion	No. of Samples >= Absolute Distortion	Fraction of Time >= Absolute Distortion	Fade Depth (dB)	No. of Samples >= Fade Depth	Fraction of Time>= Fade Depth
Diversity								
	.2	82	83	165	.0100	5	1473	.0893
	.4	1	2	3	.0002	10	341	.0207
	.6			0	0.0000	15	91	.0055
	.8			0	0.0000	20	11	.0007
	1.0			0	0.0000	25	1	.0001
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000
Primary								
	.2	19	222	241	.0146	5	1475	.0894
	.4	3	10	13	.0008	10	642	.0389
	.6	3	4	7	.0004	15	165	.0100
	.8	1	3	4	.0002	20	28	.0017
	1.0	1		1	.0001	25	7	.0004
	1.2	1		1	.0001	30	4	.0002
	1.4	1		1	.0001	35		0.0000
	1.6	1		1	.0001	40		0.0000
	1.8	1		1	.0001	45		0.0000
	2.0	1		1	.0001	50		0.0000
Recv.-On line								
	.2	15	176	191	.0116	5	926	.0561
	.4		1	1	.0001	10	343	.0208
	.6			0	0.0000	15	58	.0035
	.8			0	0.0000	20	5	.0003
	1.0			0	0.0000	25		0.0000
	1.2			0	0.0000	30		0.0000
	1.4			0	0.0000	35		0.0000
	1.6			0	0.0000	40		0.0000
	1.8			0	0.0000	45		0.0000
	2.0			0	0.0000	50		0.0000

Table 39. Distribution of Distortion Event Durations and Intervals Between Events for the Primary Receiver, Using Standard Sweep 0 0 54, Mt. Venda to Mt. Corna, 13-14 May 1980

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2200-300							
	.2	0	155	1.0000	0	155	1.0000
		1	13	.0839	1	149	.9613
		2	10	.0645	2	145	.9355
		4	7	.0452	4	141	.9097
		8	3	.0194	8	134	.8645
		16	2	.0129	16	128	.8258
		32			32	107	.6903
		64			64	77	.4968
		128			128	45	.2903
		256			256	14	.0903
		512			512	1	.0065
		1024			1024		
		2048			2048		
2200-300							
	.4	0	6	1.0000	0	6	1.0000
		1	3	.5000	1	6	1.0000
		2	1	.1667	2	4	.6667
		4	1	.1667	4	4	.6667
		8			8	3	.5000
		16			16	3	.5000
		32			32	3	.5000
		64			64	3	.5000
		128			128	3	.5000
		256			256	3	.5000
		512			512	1	.1667
		1024			1024	1	.1667
		2048			2048	1	.1667

Table 40. Distribution of Distortion Event Durations and Intervals Between Events for the Diversity Receiver, using Standard Sweep 0 0 54, Mt. Venda to Mt. Corna, 13-14 May 1980

Hour	Distortion Level Exceeded During the Event	Distortion Event Duration (Seconds)	No. of Distortion Events Whose Length Exceeds Duration	Fraction of Distortion Events Whose Length Exceeds Duration	Intervals Between Distortion Events (Seconds)	No. of Intervals that the Duration Was Exceeded	Fraction of Intervals that the Duration Was Exceeded
2200-300							
	.2	0	130	1.0000	0	130	1.0000
		1	7	.0538	1	125	.9615
		2	6	.0462	2	125	.9615
		4	4	.0308	4	124	.9538
		8	2	.0154	8	119	.9154
		16			16	114	.8769
		32			32	97	.7462
		64			64	75	.5769
		128			128	47	.3615
		256			256	13	.1000
		512			512	5	.0385
		1024			1024		
		2048			2048		
2200-300							
	.4	0	2	1.0000	0	2	1.0000
		1	1	.5000	1	2	1.0000
		2			2	1	.5000
		4			4	1	.5000
		8			8	1	.5000
		16			16	1	.5000
		32			32	1	.5000
		64			64	1	.5000
		128			128	1	.5000
		256			256	1	.5000
		512			512	1	.5000
		1024			1024	1	.5000
		2048			2048	1	.5000

Table 41. Event Occurrences during the 13-14 May 2200-0300 Data Period

Start time - 13 May 1980 2200hr
Path - Mt. Venda to Mt. Corna

Standard Spectral Density Sweep No. 0 0 54
Distortion Threshold : Div= 0.00 dB/MHz Pri= 0.00 dB MHz

	Diversity Receiver				3levl	Ref-	Rcvr	Primary Receiver			
	Distortion (dB/MHz)				Error	rame	on	Distortion (dB/MHz)			
Sweep No.	Minumum	Maximum	Distortion	Fade(dB)	Event	Event	Line	Minimum	Maximum	Distortion	Fade(dB)
0 10 51	-.1 72.9	.3 67.7	-.08	12.3	0	0	D	1.5 67.7	2.4 71.4	.25	33.7
0 21 48	2.9 67.7	4.2 72.2	.28	16.1	0	0	P	.1 72.9	.3 67.7	-.04	8.1

part of the data is in terms of amplitude distortion slope across the band (67.7 to 72.9 MHz). The slopes were calculated by obtaining the difference of spectral density amplitude corresponding to the two end points of the IF band and dividing that difference by the difference in the corresponding IF frequencies. This analysis shows most of the distortion (null information is lost) while eliminating much of the test instrumentation noise from the data. For this reason, the heavy fading period data is presented in both ways (maximum distortion measured during a sweep and distortion measured across the band).

5.1 Heavy Fading Period

The first results presented are the time functions of flat fading and distortion obtained for early morning hours from the Venda-Corna receivers (Figures 6 and 7). From these figures, it appears that nulls in the frequency spectrum often correspond to the flat fading nulls since the slope of the distortion in dB/MHz often changes sign at the sample corresponding to the flat fading null (Figures 6, 7 and 8). Figure 8 shows a detailed example of this change in sign. The null itself, however, occurred between sweeps.

An important observation obtained from these functions is that while some of the distortion seems to be of a continuous nature, another component seems to be discontinuous (at least on a second by second basis). This characteristic, as well as the fact that the selected sample sweep affects the average amplitude of this "discontinuous" distortion, leads one to suspect that the more slowly varying short-term average better represents the amplitude distortion characteristic of the path as a function of time. A large number of analog sample playbacks of the recorded envelopes of the IF spectral density functions show noise on these functions (Figure 9). For this reason, the data was reanalyzed, ignoring nulls, measuring only slopes across the IF band. As seen from Figures 10 and 11, a function is obtained which is very much like the short-term average of distortion values based on maximum slopes (Figures 6 and 7).

From Figures 6, 7, 10, and 11, it becomes clear that diversity switching has the potential for being very effective in counteracting the effect of slope distortion as well as nulls. Therefore, it is very important that the switching threshold power ratio of the diversity switch be kept small and that switching be permitted at relatively high levels of received signal level which is not now the case for the DEB receivers. Table 6, 14, 26, and 38 show quantitatively the amount by which the DEB I diversity system reduced the distortion of the receiver-on-line compared to the distortion from a single receiver. This reduction can best be observed by comparing

the distortion distributions for the primary and diversity receivers with the one for the receiver-on-line (especially the column for number of samples greater than or equal to particular absolute value of distortion). This comparison shows that the DEB I diversity system provides fairly good protection against large values of distortion but very little protection against the smaller values of distortion.

Using information from the radio manuals, the DEB I diversity system using the FRC-162 radios has the following characteristics:

1. The switching threshold power ratio (hysteresis) = 5 dB.
2. The system will not switch radios until the receiver-on-line fades down to approximately -65 dBm (about 30 dB below the median level) and then only if the receiver-off-line is at a 5 dB higher level.
3. The switch response time (the period between an event which will cause switching and the time until the switch starts to react) is approximately 2 milliseconds. (This information was obtained from Mr. James Hefner of Collins Corporation.)

Fade levels corresponding to the various switching events in Table 22 confirm operation roughly consistent with the combiner characteristics given in 1 and 2 above. Consideration of the combiner properties and careful observation of Figures 10 and 11, using a straight edge to line up concurrent fading and distortion events, shows how little of the potential diversity improvement of on-line-receiver distortion avoidance is presently being realized. It must be stated here, however, that for this system (12.6 Mb/s) the additional distortion avoidance hardly seems needed considering the very few frame loss events shown in Table 22. Figures 10 and 11 show that the distortion occurs in events (similar to fades). If the combiner switches in a manner such that the receiver-on-line is always the one with the greatest RSL, the effect on traffic of many of the distortion events will be eliminated entirely and at least parts of the others will be reduced in magnitude. If the receiver-on-line is to be the one with the greatest RSL, certain conditions are necessary: switching must not be disabled at high RSL levels, the switching threshold power ratio must be close to 0 dB, and the switch response time must be very short (a few milliseconds).

Figures 12, 13 and 14 are plots of distortion values at the fade depth at which they occurred. These three figures include nulls and noise with a small band of points at relatively high signal levels that lie above a small "forbidden" zone. The points that lie above the "forbidden" zone and at high RSLs were introduced by a digitizing error introduced by an optional audio signal used by the digitizer operator to determine that data were being digitized. These figures as well as

Table 25 show that the largest values of distortion are associated with the deep RSL fading nulls. Figure 15 is the same type of diagram as Figures 12, 13 and 14 but shows slopes only. It is clear from Figure 15 that the distribution of distortion amplitudes widens rapidly for decreasing signal levels. It is also clear that for this 5-hour period the distortion slopes are primarily negative and generally increase in amplitude as signal level decreases. The reason for the preponderance of negative slopes is not clear. We are confident that it is a measured effect on this path and not the result of a bias introduced by test equipment operation or the digitization of the analog data. A preferred atmospheric structure seems to exist during multipath conditions causing a preferred range of amplitudes and rf phase delays.

The data set for May 28, 1980, 2300 hours to May 29, 1980, 0400 hours is also presented in terms of cumulative distributions of distortion values, fade depths, distortion durations and intervals between distortion events. Tables 6 through 13 present these distributions with noise and nulls. Tables 14 through 21 present the data for slopes only.

Selected sets of values for this period are presented in terms of maximum distortion. The first set (Table 22) lists the sweeps during which events occur. The event types are a change of receiver-on-line status, a reframe event, or a 3-level-error event. A 3-level-error event was recorded only if a minimum of 0.002 seconds had passed since the start of the previous one. The pulse had to be stretched to this period so that the recording electronics would be able to detect it. The same conditions applied to reframe events. The second set of values (Tables 23 and 24) list the sweeps during which distortion exceeded 0.5 dB/MHz. The third set of values (Table 25) is a presentation of sweeps during which flat fading exceeded 35 dB.

5.2 Moderate Fading Period

Much the same type of results presentation is made for the moderate fading period (May 12, 1980, 2300 hours to May 13, 1980, 0400 hours) as was made for the heavy fading period. Two hours of time functions of flat fading and distortion are presented (Figures 16 and 17). These figures presented distortion in terms of slope across the IF band. The same is true for Figure 18 which is a correlation plot of distortion in terms of flat fading. These three figures are consistent with the heavy fading results. Distortion is somewhat less because there is less flat fading. These three figures show that the flat fading channels of the recording system become unstable at high signal levels. This is particularly apparent in the plots for the diversity receiver in Figures 16 and 18. The narrow vertical strips

in Figure 18 are caused by the flat fading digitizing granularity. These strips also appear on the other correlation plots and vary somewhat depending on the slope of the particular calibration.

Tables 26 through 33 are time distributions of event durations, distortion values, and fade depths. In the distributions related to distortion, distortion is calculated in terms of slope across the IF band. Tables 34 through 37 are selected sets of values for the moderate fading period and are presented in terms of maximum distortion. The data set types are the same as those described in the heavy fading section.

5.3 Light Fading Period

The light fading period was from 13 May 1980, 2000 hours to 14 May 1980, 0300 hours. The results for this period are presented in terms of maximum distortion within the band instead of slope of distortion across the band. The manner in which the distortion is presented makes little difference since very little distortion was observed. Figure 19 is a correlation plot of distortion and flat fading depth. As was the case for the heavy and moderate fading periods, distortion slopes were predominately negative and the distribution of distortion values widens as flat fading depth becomes greater. Tables 38, 39, and 40 are the time distributions of distortion values, flat fade depths and event durations. Table 41 indicates that there were no 3-level-errors or reframe events during this period but that there were receiver switching events.

6. CONCLUSIONS

1. Consideration of the data in Figures 15, 18, and 19 shows a consistent statistical relationship between the depth of RSL fades and the amount of amplitude distortion. This relationship is one in which the probability of large distortion values increases with increasing fading depth. This is of particular interest since the data in Figure 15 shows depressed median signal levels (approximately 6 to 10 dB) on both primary and diversity receivers. (See Figures 10 and 11.) This consistency leads one to conclude that a useful relationship between calculated or measured estimates of the time distributions of multipath fading and distributions of amplitude distortion can be made. This conclusion holds for relatively narrow band systems (up to approximately 50 MHz) since ultimately, for very wideband systems, there will not be any significant RSL multipath fading. This relationship should contain the same type of occurrence factor as is used in the multipath fading prediction models. The nature of the distribution within a multipath fading period for the 8 GHz band and for distortion slopes less than 0.6 dB/MHz is considered to

be log linear (see Table 14). A rough cut at an empirically derived relationship is:

$$P_m = Q\left(\frac{f}{4}\right)^{1.2} (d^{3.5})\ 10^{-5\delta}. \qquad (1)$$

This expression uses the occurrence factor suggested by Morita (1970), page 810. The occurrence factor is less than 1, such that:

$$Q\left(\frac{f}{4}\right)^{1.2} (d^{3.5}) < 1. \qquad (2)$$

P_m = the fraction of time that the distortion is greater than a given value of δ during the worst fading season

δ = the distortion in dB/MHz. $(0<\delta<0.6)$

d = the path length in km. $(d>50)$

f = the frequency in GHz. $(1<f<50)$

$Q = 2 \times 10^{-9}$ over mountains

$Q = 5.1 \times 10^{-9}$ average terrain

$Q = 3.7 \times 10^{-7}(1/h)^{0.5}$ over water and coastal areas

h = average path height above ground in meters.

An estimated occurrence factor value for a path may be derived from the distribution of flat fading data obtained during the worst fading month. The estimate is obtained by observing the fraction of time that flat fading exceeds 20 dB during the worst fading month and then dividing that value by 0.0069. See Hause and Wortendyke (1979), p. 36. The slope of the log linear distribution, $10^{-5\delta}$, whose probability of occurrence is predicted by the Morita model, was selected from the distortion (slope) distributions in Table 14. The fraction of time during which greater than a given absolute value of distortion was observed is plotted for both the diversity and primary receivers (Figure 20). The data population used for selecting this distribution is small. A much larger data base is required to make an estimate of the distribution characteristics in which one can legitimately place a high degree of confidence. With these qualifications in mind, application of the distortion prediction equation to the Venda-Corna path on 8.3 GHz for the worst month estimates the single-receiver probability of distortion greater than 0.2 dB/MHz to be:

$$P_m = 5.1(10)^{-9} \left(\frac{8.3}{4}\right)^{1.2} (90.2)^{3.5}\ 10^{-5(0.2)}. \qquad (3)$$

P_m = .0085 of the worst month, but without diversity improvement as mentioned above.

2. We conclude that for DEB I, amplitude distortion for this narrow band (approximately 14 MHz) system is not a significant factor in its performance. (See Tables 22, 34, and 41.)

Out of 15 hours of data, 6 reframe events are recorded (much less than 12 milliseconds outage time). The multiplex has a reframe recovery time less than 0.5 millisecond. All six of these reframe events occurred when the receiver-on-line indicated a distortion value equal to or less than 0.25 dB/MHz and four of them occurred when the distortion value was equal to or less than 0.1 dB/MHz, which indiates that these events may not be related to the distortion level at the time of the event since higher distortion levels are observed when no reframe or 3-level-error events occur (Tables 23 and 24).

3. Diversity switching is a very effective way of reducing the effects of amplitude distortion (Section 5.1). Figures 6, 7, 10, 11, 16, and 17 show how effective diversity can be if 1) the switch controller is properly aligned; 2) the switching threshold differential is low enough (<3 dB) and, 3) the switch is set to operate at high as well as at low signal levels. Diversity switching is especially useful in reducing the effects of distortion nulls since these nulls correspond strongly to the RSL fading nulls. See Figures 6, 7, 10, and 11.

4. The distortion changes at a slow enough rate so that the combiner response time presently available is sufficient (Section 5.1).

5. Future testing needs to be done to advance development of performance prediction models. In order to carry out this testing and development, several things should be done.

a) Obtain a large population of differential distortion values so that a better estimate of the characteristics of the short-term time distribution which pertain to multipath fading periods, can be obtained.

Some of the things which can be done to maximize the amount of this data while minimizing the test duration are:

1) Obtain data using a radio with a wide frequency spectrum that is fairly flat across the band.

2) Measure long links (80 km or greater) with sufficient terrain clearance in reasonably warm, humid climates where the difference in antenna heights above mean sea level at each end of the path is small enough such that the absolute value of the antenna elevation angle is less than 0.8 degree at each end of the path. (Draft report, Fading on long LOS 8 and 15 GHz paths, L.G. Hause.)

7. REFERENCES

Anderson, C.W., S. Barber, and R. Patel (1978), "The Effect of Selective Fading on Digital Radio", IEEE International Conference on Communication 78, Toronto, Ont.

Barber, S., and C.W. Anderson (1977), "Modulation Considerations for the RD-3 91 Mb/s Digital Radio", IEEE International Conference on Communications, ICC 77, Chicago, IL.

Dougherty, H.T., and W. Hartman (1977), "Performance of a 400 Mb/s System Over a Line-of-Sight Path", IEEE Trans. Comm. COM-25, No. 4.

Hause, L.G., and D.R. Wortendyke (1979), Automated Digital System Engineering Model, NTIA-Report-79-18.

Morita, K. (1970), Prediction of Rayleigh fading occurrence probability of line-of-sight microwave links, Rev. Elect. Comm. Lab., NTT, Japan, 18, 11-12.

Smith, D.R., and J. Osterholz (1979), Assessment of Frequency Selective Fading on DCS Transmission System Performance, Defense Communications Engineering Center Engineering Publication No. 5-79.

3) Measure the amplitude of the whole spectral density function or many discrete values between the edges of the spectrum (not just the edge values).

4) Measure both the primary and diversity receiver spectral density function envelopes.

b) Obtain data that will result in a prediction method for estimating the reduction of receiver-on-line distortion by diversity performance.

To achieve this end, the following steps are recommended:

1) Obtain time corresponding values of fade depth and distortion on primary and diversity receivers.

2) Monitor both receivers on a path configured with a typical space diversity system.

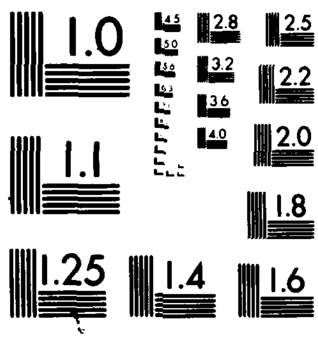
3) After digitizing the various data and time channels, use computer programs to obtain distributions of distortion for the receiver-on-line for various values of diversity switching threshold differential.

c) Determine the sensitivity of the radio to distortion, by monitoring receiver switching, frame error and format violations or events to determine the susceptibility of the particular radio system to distortion.

AD-A099 490 NATIONAL TELECOMMUNICATIONS/INFORMATION ADMINISTRATIO--ETC F/G 17/2.1
SELECTIVE FADING ON 8 GHZ LONG PATHS IN EUROPE.(U)
MAR 80 L G HAUSE DCFR-040022
UNCLASSIFIED DCEC-R-040022 NL

2 of 2

END
DATE
FILMED
7-81
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

DISTRIBUTION LIST

STANDARD:

R100 - 2
R102/R103/R103R - 1
R102M - 1
R102T - 9 (8 for stock)
R104 - 1
R110 - 1
R123 - 1
R124A - 1 (for Archives)

R200 - 1
R300 - 1
R400 - 1
R500 - 1
R700 - 1
R800 - 1
NCS-TS - 1
101A - 1
312 - 1

* R102T - 12 (Unclassified/Unlimited Distribution)

DCA-EUR - 2 (Defense Communications Agency European Area
ATTN: Technical Director
APO New York 09131)

DCA-PAC - 3 (Commander
Defense Communications Agency Pacific Area
Wheeler AFB, HI 96854)

DCA SW PAC - 1 (Commander, DCA - Southwest Pacific Region
APO San Francisco 96274)

DCA NW PAC - 1 (Commander, DCA - Northwest Pacific Region
APO San Francisco 96328)

DCA KOREA - 1 (Chief, DCA - Korea Field Office
APO San Francisco 96301)

DCA-Okinawa - 1 (Chief, DCA - Okinawa Field Office
FPO Seattle 98773)

DCA-Guam - 1 (Chief, DCA - Guam Field Office
Box 141 NAVCAMS WESTPAC
FPO San Francisco 96630)

US NAV Shore EE PAC - 1 (U.S. Naval Shore Electronics Engineering
Activity Pacific, Box 130, ATTN: Code 420
Pearl Harbor, HI 96860)

1843 EE SQ - 1 (1843 EE Squadron, ATTN: EIEXM
Hickam AFB, HI 96853)

DCA FO ITALY - 1 (DCA Field Office Italy, Box 166
AFSOUTH (NATO), FPO New York 09524

(continued)

DISTRIBUTION LIST (cont'd)

USDCFO - 1 (Unclassified/Unlimited Distribution)
(Chief, USDCFO/US NATO
APO New York 90667)

SPECIAL:

RADC
ATTN: DCLD
Griffiss AFB, NY 13442

Commander
ESD
ATTN: DCF-1 (Capt. Jack Machuzak)
Hanscom Field, MA 01730

Commander
ESD
ATTN: WE (Mr. Owen Cote)
Hanscom Field, MA 01730

Commander
AFCC
ATTN: 1842 EEG (Mr. Dennis Buck)
Scott AFB, IL 62225

Commander
U.S. Army Communications Command
ATTN: CC-OPS-SM (Mr. Stan Braun)
Ft. Huachuca, AZ 85613

COMNAVTELCOM
ATTN: Code 621B (Mr. Bill Addison)
4401 Mass. Ave. N.W.
Washington, DC 20390

Officer In Charge
U.S. Naval Shore Electronics Engineering Activity
Box 91
FPO San Francisco 96651

Officer In Charge
U.S. Naval Shore Electronics Engineering Activity
Box 5
FPO Seattle, WA 98762

Commander
Headquarters USACEEIA
ATTN: CCC-TD - CCC-CED-XEM - CCC-OPS-C
Ft. Huachuca, AZ 85613

DISTRIBUTION LIST (cont'd)

Officer In Charge
U.S. Naval Shore Electronics Engineering Activity
Box 194
FPO San Francisco 96630

Mr. Paul Hartmann
Rockwell International
P.O. Box 10462
Dallas, TX 75207

Mr. Tom Giuffrida
Bell Labs
Holmdel, NJ 07703

Mr. Stephen Matsuura
USACEEIA
ATTN: EMEO
Ft. Huachuca, AZ 85613

Mr. Andrew E. Hooper
NUWES
Keyport, WA 98345
ATTN: Code 8013A

Mr. Henry C. Merhoff
PACMISTESTCEN
Pt. Mugu, CA 93042

Mr. Adrian Eley
ATTN: Code R153
NSA
Ft, Meade, MD 20755

Mr. Steve Barber
Bell Northern Research
Ottawa, Ontario, Canada

Mr. Arvids Vigants
Bell Labs
Holmdel, NJ 07703

Mr. James L. Weblemoe
PACMISTESTCEN
Pt. Mugu, CA 93042

Mr. Jyoti S. Sharma
Western Union
One Lake Street
Upper Saddle River, NJ 07458

DISTRIBUTION LIST (cont's)

Mr. Ed Lyons
NSA
Ft. Meade, MD 20755
ATTN: Code R153

Mr. John K. Webb
MITRE
Bedford, MA 01730

Mr. Gayton Yancy
Raytheon
1415 Boston-Providence Turnpike
Norwood, MA 02062

Mr. Gerry Blakefield
TRW
One Space Park - Building R2, Room 2178
Redondo Beach, CA 90278

Dr. Phil Bello
CNR, Inc.
220 Reservoir St.
Needham, MA 02194

Dr. Ronald L. Mitchell
NEC America, Inc.
9218 Markville Drive
Dallas, TX 75243

LMED

8